THE *Soybean Digest*

REG. U. S. PAT. OFF.

GEO. M. STRAYER, Editor KENT PELLETT, Managing Editor

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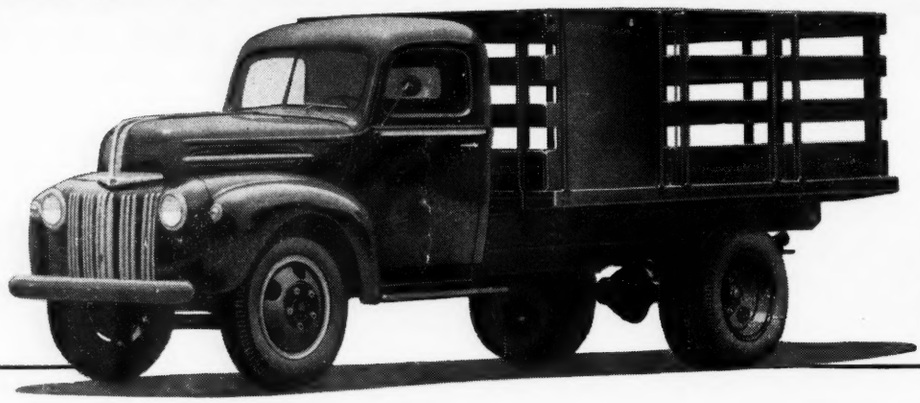

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26th ANNUAL CONVENTION

AMERICAN SOYBEAN ASSOCIATION

WITH THE SOYBEAN industry in the process of being released from governmental control to take its place in a free economy, the 450 leaders who attended the 26th annual convention of the American Soybean Association at St. Louis, Mo., Aug. 29-31 met to take stock of a new set of conditions and to lay the groundwork for completing the postwar readjustment.

Soybean processor contracts with Commodity Credit Corporation will not be renewed in 1946, and existing set-aside and limitation orders on soybean products will be terminated in the not distant future, C. C. Farrington, assistant administrator of the Production and Marketing Administration, told the convention.

About all that will remain of the government's wartime program will be the support price which is mandatory for 2 years yet under the Steagall act, and the U. S. Department of Agriculture acreage goals.

The confidence of the group that the soybean industry will be able to take the postwar bumps as they come was perhaps best expressed by Whitney H. Eastman, president of the Chemical Division of General Mills, Inc. He said: "There is a growing feeling on the part of a widespread group of agricultural and industrial economists that the demand for soybean products will soon exceed the demand for all other domestic oilseed products combined. The feeling is persistently strong that this broad demand for soybean products can be met at price levels which will permit the soybean processor to pay the grower an attractive price."

Growers, grain handlers, processors, industrial and governmental research men and other leaders of the industry attended the 3 days' sessions which were climaxed with a trip to the Ralston Purina Co. research farm at Gray Summit, Mo.

Thirty states, as well as Canada, the British Isles, the Union of South Africa, Brazil and Australia were represented. The attendance of people from foreign countries at the convention was an expression of the strong current interest of other nations in the American soybean crop and industry. Extensive efforts are being made to stimulate soybean production abroad.

Visitors from foreign countries included:

C. J. McKeon, director of agriculture, Brisbane, Australia.

H. A. Grantham, agronomist, Sydney, Australia.

Frank Dawe, chief engineer Swift International, Sao Paulo, Brazil.

A. R. Saunders, assistant director of agriculture, Pretoria, Union of South Africa.

Dr. A. F. H. Blaauw, technical division food department, Lever Bros. and Unilever, London, England.

Walter W. McLaughlin of McLaughlin Agricultural Service, Decatur, Ill., was elected president, succeeding Howard L. Roach, J. Roach Sons, Plainfield, Iowa, who retired after 2 years of service.

J. B. Edmondson, Wampus Farm, Clayton, Ind., was elected vice president; and Geo. M. Strayer, Strayer Seed Farms, Hudson, Iowa, was reelected secretary, which office was combined with that of treasurer this year.

Directors elected for 2 years: Strayer and McLaughlin; G. G. McIlroy, Farm Management, Inc., Irwin, Ohio; Harry Plattner, Malta Bend, Mo.; W. G. Weigle, Van Wert, Ohio; and L. F. Stoner, Holly Bluff, Miss.

Directors for 1 year: Roach and Edmondson; Frank Garwood, Stonington, Ill.; Jacob Hartz, Hartz Seed Co., Stuttgart, Ark.; Ersel Walley, Walley Agricultural Service, Fort Wayne, Ind.; John Dries, Saukville, Wis.; and John W. Evans, Montevideo, Minn.

DIRECTORS FROM NEW STATES

Directors were elected from Mississippi and Minnesota this year in recognition of the growing importance of the soybean crop in those states. Six directors were elected for 2-year terms for the first time in accordance with the provisions of the recently adopted articles of incorporation and by-laws of the Association.

Dr. W. J. Morse, principal agronomist of the USDA Bureau of Plant Industry, and Dr. W. L. Burlison, head of the Department of Agronomy, University of Illinois College of Agriculture, were elected the first honorary life members of the Association. Presentations were made by E. F. Johnson, St. Louis, and Walter McLaughlin.

Dr. Morse's work in importation of large numbers of soybean strains from the Orient is well known. He helped organize the American Soybean Association, served as its president in 1924 and 1925, and has been active in the preparation of every convention, as pointed out by Johnson.

Dr. Burlison has been working with the soybean crop for 41 years. He was one of the originators of the American Soybean Association and has served as its president and secretary.

"He, also, together with J. C. Hackleman and others, helped organize the National Soybean Processors Association, and helped bring about friendly relations between the producers and the processors, in their mutual problem of utilization of the rapidly expanding production of beans in the Cornbelt," said McLaughlin. "He pioneered in the use of soybean oil in paints. It goes without saying that in his research he has done much toward the development of other crops as well as soybeans."

A memorial to the late John T. Smith, Tolono, Ill., pioneer soybean grower, who has died since the last meeting, was presented by McLaughlin on behalf of the resolutions committee.

The 17 exhibit booths of firms serving the industry were centers of interest during the convention.

Exhibitors included:

Seedburo Equipment Co., Chicago
National Association of Margarine Manufacturers, Washington, D. C.
The Albert Dickinson Co., Chicago
Butler Food Products, Cedar Lake, Mich.
Ralston Purina Co., St. Louis
Soybean Paint & Varnish Institute, St. Louis
Dixie Machinery Mfg. Co., St. Louis
The Nitragin Co., Inc., Milwaukee, Wis.
The Urbana Laboratories, Urbana, Ill.
Neff & Fry Co., Camden, Ohio
J. C. Kintz Co., Cedar Rapids, Iowa
Eriez Manufacturing Co., Erie, Penn.
Bemis Bro. Bag Co., St. Louis
Dave Fischbein Co., Minneapolis, Minn.
Fulton Bag & Cotton Mills, St. Louis
The Soybean Digest, Hudson, Iowa
V. D. Anderson Co., Cleveland, Ohio

The 1947 convention will go to Columbus, Ohio. The board of directors acted on invitations extended to the Association by Ohio's Governor Frank J. Lausche, James A. Rhodes, mayor of Cleveland, and Dr. R. D. Lewis, until recently head of the Department of Agronomy, Ohio State University.

The trip to the 712-acre Ralston Purina farm, where visitors spent much of one day viewing the extensive livestock feeding experiments being carried on at the farm, was a most enjoyable occasion. A sumptuous, old-style farm dinner was served at noon.

President's Address

It has been 2 years since we last met in convention of the American Soybean Association. It is always an inspiration to greet old friends and to meet new people having mutual interests. Conventions also give us an opportunity to review past accomplishments and to make plans for future action.

Sometimes the question arises as to the purpose of the American Soybean Association in addition to the publication of the

Soybean Digest, and the holding of conventions. In order that you may be informed on this subject, and also to refresh our minds on some of the events affecting the soybean industry since we last met, I would like to review briefly a few of the accomplishments in which the American Soybean Association played either a major or minor role.

Unadapted varieties of soybeans which were being sold at high prices, with misleading statements regarding productivity, oil content and maturity, were investigated and as a result, federal action was taken to make it unlawful to sell McClave soybeans by that name or any other name.

The use of soy flour in bread was declared legal and bakeries were again allowed to use this product in all baking goods offered for sale to the consuming public.

In some sections of the soybean growing areas, plant diseases were beginning to cut production and adversely affect the crop. The American Soybean Association, together with the National Soybean Processors Association, and other interested organizations and individuals, interviewed the proper authorities at Washington and as a result an appropriation of $70,000 was made available starting with the 1945 fiscal year which was July 1, 1945.

Greatly expanded soybean disease and insect pest studies have now been instituted throughout the soybean growing areas as a result of this appropriation. Timely study of soybean diseases and pests will save the industry countless dollars in the future.

Meetings were held with the manufacturers of soy butter to determine what action could be taken to allow this product to be offered for sale without legal restrictions.

Fats and oils with respect to competition with imported tropical oils were discussed with the Agricultural Adjustment Administration and other government bureaus. There were candid exchanges of opinion which will develop mutual better understanding between government agencies and soybean growers.

A ruling was made by the Bureau of Animal Husbandry allowing the use of soy products in processed meats. Heretofore only cereals were allowed in sausage, meat loaves, and other products.

A survey was conducted of research being carried on in soybeans in the soy belt and as a result challenging editorials were carried in the *Soybean Digest*. The survey and editorials provided serious thinking on the part of research directors and the result has been an awakening interest in soybean research.

Throughout the 2 year period now closing, your officers and directors have been repeatedly called to committee meetings of the AAA, have conducted and spoken at meetings called for the purpose of encouraging the growing of soybeans, and have had conferences with the fats and oils branch of the USDA before cropping plans for the following years were set up.

Your officers have appeared at congressional hearings regarding the lifting of restrictions on the sale of margarine manufactured from domestic produced fats and oils. It is gratifying to report that the National Association of Margarine Manufacturers has recently announced that henceforth all margarine made by members of this Association would be made from fats and oils grown in the United States.

For several years the matter of the incorporation of the American Soybean Association has been under consideration. As a result of the work of a special committee appointed to investigate the desirability of incorporating, the American Soybean Association started operations as a corporation, not for pecuniary profit, under the corporation laws of the State of Iowa on February 28, of this year.

These, then, are a few of the highlights of the activities of the American Soybean Association in the busy 2 year period just ending. The record has been written. Now is the time to look forward in this postwar adjustment period to new goals and new accomplishments. Each one of us can play his part in reshaping this postwar world and making it the kind of world in which we want to live and in which to raise our children.

Should I be called upon to formulate a program for the American Soybean Association in the year and years to come, it would include the following objectives.

1. Give our support and encouragement to all research programs whether initiated by federal government, our state experiment stations or by private industry. Each one of us either knows, or has a friend who knows a senator, a representative, or a member of our respective state legislatures. When funds are asked for research, let your wishes be expressed. Our elected representatives are anxious to do our bidding, if they know what we want.

2. Work closely with industry in finding and exploiting new and known uses for both soybean oil meal and oil. If every-

(*Continued on page* 18)

Some members of the new ASA board of directors. Back row, from the left: Secretary-treasurer Geo. M. Strayer, Hudson, Iowa; Vice President J. B. Edmondson, Clayton, Ind.; Ersel Walley, Fort Wayne, Ind.; G. G. McIlroy, Irwin, Ohio. Front row: Harry W. Plattner, Malta Bend, Mo.; Jacob Hartz, Sr., Stuttgart, Ark.; Howard L. Roach, Plainfield, Iowa; President Walter W. McLaughlin, Decatur, Ill.; and John Dries, Saukville, Wis.

On the opposite page are some of the pictorial shots taken by the convention photographer. You'll recognize most of these people if you were one of the lucky ones who attended. Most of them are familiar to DIGEST readers, anyway.

At top left, Dr. W. L. Burlison, head of the agronomy department, University of Illinois, visits for a moment at the Ralston Purina farm with Heartsill Banks, who has just resigned his position with Purina to undertake a rice mission in Korea for the U. S. government. To the right, retiring president Howard L. Roach and Mrs. Roach of Plainfield, Iowa, visit with new president Walter W. McLaughlin and Mrs. McLaughlin of Decatur, Ill.

Just below at left are some of the Ralston Purina Co. executives in the firm's exhibit booth. They are: Ralph Guenther, Lafayette, Ind.; John B. Brown, Don B. Walker, Earl A. Sindecuse, E. G. Franze, and J. T. O'Connor, all of St. Louis; H. N. Johnson, Iowa Falls, Iowa; and Van Couch, Circleville, Ohio. At right, talking it over in the dairy barn on the Purina farm are ASA Director John Dries, Saukville, Wis.; Convention Speaker H. I. Cohn, Valley and Cypress Farms, Carrollton, Ill.; President Howard L. Roach, Plainfield, Iowa; and Dr. Chas. W. Cook, research director for Victory Mills, Ltd., Toronto, Canada.

In the next row at left, Dr. A. F. H. Blaauw, Lever Bros. and Unilever, Ltd., London, England, examines the turkeys at the Purina farm; at right, at the Friday evening banquet are C. J. McKeon, minister of agriculture, Brisbane, Australia; Frank Dawe, chief engineer for Swift International, Sao Paulo, Brazil; Dr. A. R. Saunders, director of agriculture, Pretoria, Union of South Africa; and H. A. Grantham, agronomist, Sydney, Australia.

Below, at left, some of the processors visit. From left to right, Sewall Andrews, chemical division, General Mills, Inc., Minneapolis; Walt Flumerfelt, manager of Belmond, Iowa, operations of General Mills; Clark Cooley, grain buyer, Spencer Kellogg & Sons, Inc., Des Moines, Iowa; H. D. Egly, president Victory Mills, Ltd., Toronto; Harry Schultz, vice president soy products division, Pillsbury Mills, Clinton, Iowa; H. H. Richardson, in charge of grain purchases, Spencer Kellogg & Sons, Inc., Buffalo, N. Y.; W. W. Hastings, Buckeye Cotton Oil Co., Cincinnati, Ohio; and John Caldwell, Jr., Hoosier Soybean Mills, Marion, Ind.

At right a little discussion by R. B. Williams, Buckeye Cotton Oil Co., Louisville, Ky.; W. E. Riegel, past president ASA, Champaign, Ill.; Dr. G. E. Hilbert, director Northern Regional Research Laboratory, Peoria; and Dr. R. T. Milner, director of the analytical section of the Northern Laboratory. Mr. Riegel, apparently in good health at the convention, was stricken and died shortly after his return home.

At center bottom you see the speakers' table at the banquet. Left to right, E. A. Cayce, vice president Ralston Purina Co., and Mrs. Cayce, St. Louis; C. C. Farrington, assistant administrator Production and Marketing Administration, Washington, D. C., speaker of the evening; President and Mrs. Roach; and Jeanne M. and Geo. M. Strayer, editor of SOYBEAN DIGEST, Hudson, Iowa.

They Met in St. Louis

one interested in soybeans insisted on soybean paint for his buildings, what a tremendous outlet for soybean oil we would have. If every soybean farmer insisted on soybean meal in his livestock and poultry feeds, we would have to grow still more soys to fill the demand.

3. Keep vigilant watch on any and all legislation which might affect the uses of soy products in either industry or human food. The time has come when the products of American farms should have free access to the consuming market and not have to hurdle restrictions set up in the name of the farmer but actually for the benefit of the manufacturer.

Drs. W. J. Morse and W. L. Burlison acknowledge honorary life memberships

4. The American Soybean Association should continue to stand ready to consult with and assist any and all governmental agencies, formulating policies affecting the production, handling and marketing of soybeans and soybean products.

Recognizing that the future field of expansion in the utilization of soybean products in the United States lies in the industrial field, we should strive to supply the type, quality, and quantity of soybeans which will encourage maximum uses of research findings and endeavors.

It has been a pleasure to have been able to serve the American Soybean Association during the past 2 years. Many things have been accomplished but we should all realize that in the 26 years of our existence, only the preface of the first chapter of the book on soybeans has been written.

May the American Soybean Association continue to prosper in the future as it has in the past and may its aim ever be to promote the soybean for the good of all mankind.

Howard L. Roach, President

Report of Secretary

1944-45 and 1945-46 Fiscal years

Because there was no American Soybean Association convention held in 1945, this report will cover the activities of your Association for the period from September 1, 1944 to September 1, 1946. During that 2 year period, your secretary spent 17 months in the Army of the United States, on military leave from A. S. A. During that period of time Mrs. Strayer served as secretary. This report, therefore, must be a joint report.

Soybeans, during that war period, have been playing an extremely important part in both the winning of the war and the coming of peace. Producing the raw material for fantastic quantities of soybean oil, soy flour, soy grits, and soybean oil meal for livestock feeding, the producers of soybeans played an extremely important part in the war effort. Now, our task is still that of feeding the world. Soybeans, and their protein and fat derivatives, are continuing to play an important part.

During the 2 year period, the American Soybean Association office has been called upon to supply soybean statistics and information on nearly every phase of the industry. We have had large numbers of requests from outside the United States for information on developments within the industry during the war years. There have been many orders for complete sets of copies of the *Soybean Digest* covering the years when mailings were cut off during the war. We have attempted to organize files of information on soybean subjects, in order that we might more adequately answer the inquiries reaching us.

During the first 1½ years of this 2 year period, the supplies of paper were limited by governmental order. Our base period on paper came at a time when the *Soybean Digest* was just getting its feet wet, and it therefore was so small that there was no possibility of expanding the circulation. We, therefore, concentrated our efforts largely on making the magazine as useful as possible to the industry. We reduced paper weight, and thus increased the number of pages. That move enabled us to accept more advertising. Since February 1946 we have been able to obtain greater paper supplies, and have started a campaign to increase the number of members and subscriptions.

To that end we have added new equipment to our facilities, including Dictaphone equipment, a folding machine, a new typewriter, and other labor saving machinery. By so doing, we have greatly increased our economy of operations, and we are able to mail a larger number of letters at a very nominal cost. Most of this equipment has been installed in recent months, thus the results do not show up in the current report of operations.

COSTS ARE RISING

Of major importance to the American Soybean Association, in my estimation, was the completion of the articles of incorporation and the by-laws, their approval by the board of directors as authorized at the 1944 annual business meeting, and their consequent filing with the Secretary of State for Iowa.

Your Association is now operating as a corporation not for pecuniary profit, under Iowa corporation law. By so doing, your directors, and each of you as members, are relieved of all responsibility for Association debts and actions. Your Association can now own property, conduct any and all business activities in the interests of the soybean industry.

I will not attempt to give a detailed financial report of operations for the two years. Two years ago, on September 1, 1944, the net worth of the American Soybean Association was $5,483.81. On September 1, 1946, the net worth, on a conservative basis, is calculated at $12,033.48, or a net gain of $6,549.67. The American Soybean Association is not organized for profit. There has been no concerted effort to accumulate funds, except as a medium of service to the industry. As the *Soybean Digest* has produced additional revenue, it has been put back into the publication in increased pages, increased art work and engravings, and in better stories. Thus, I consider the financial position of your Association to be the soundest in the history of the organization, with over twice the net worth of 2 years ago.

Our costs are now rising rapidly. The membership and subscription price was raised from $1.50 to $2.00 per year on January 1, 1946, by action of your board of directors, but that increase will not long cover the increased costs. Probabilities are we can not continue to increase the net worth of the organization as we have done during the war years, and at the same time continue the *Soybean Digest* on as extensive a basis as in the past.

While we have made remarkable strides during the past 2 years, we still have with us the same problem as in past conventions — that of adequate membership. To truly represent the soybean growers of America, we must have a major portion of them in our membership. During the past 2 years approximately 1 million farmers have been growing soybeans. Only a very small part of them have ever heard of the American Soybean Association or the *Soybean Digest*. To be active in either governmental, commercial or industrial fields we must increase the membership to a point where we can speak for the industry.

This problem is not new to us — it is one which must be solved. The 1946-47 year will be a crucial one for the soybean industry, and likewise for the American Soybean Association.

Jeanne M. Strayer and Geo. M. Strayer.

(Continued on Page 74)

The Growing
IMPORTANCE OF THE SOYBEAN CROP
In Our National and Agricultural Economy

By WHITNEY EASTMAN

President Chemical Division,
General Mills, Inc.

MUCH has been spoken and written during the past 20 years about the economic importance of the soybean crop in this country. Conservative, courageous and fearless men have expressed their views. They have received the cold facts as they know them, based on actual experience with some phase or segment of the industry.

Agronomists, soybean growers, industrialists, scientists and economists have all spoken or written favorably of their experience with the crop. However, during this 20-year period in which the crop has been commercially grown and utilized, there has been an unusual amount of unsolicited propaganda by journalists, promoters and publicity seekers. The wonder bean of the orient has been romanced and given much undeserved credit for properties it does not possess.

The crackpots and dreamers have shouted vociferously about the virtues and properties of the magic bean. Some of this propaganda has been disseminated by overenthusiastic, "get rich quick" newcomers in the business.

Great harm has come to the industry because of this excessive applause. It has been difficult for the consuming public to evaluate the statements and claims made by this vociferous group of careless, irresponsible people. It has likewise been a real task for those who have accepted leadership in the industry to develop a sound long-range program, because of all the confusion caused by a strong cross-current of public opinion.

SCARE CROWS

In addition to all this disturbing propaganda, some small but influential groups have hung out a few economic "scare crows" to stifle sound and justified enthusiasm or to otherwise further their own selfish interests. These "scare crows" are but straws in the wind to forewarn us of things to come. Who knows but that our future enemies—perhaps unknown to us now—are at work among us laying plans to effectuate economic strangulation in a possible future world conflict?

If there was ever a need in the history of this nation for a sound, unified national program to safeguard our domestic oilseed crops for the purpose of insuring national security and independence, we need such a program now. Tomorrow may be too late.

The importance of vegetable oils as well as vegetable protein concentrates in helping to win World Wars I and II is well known to the economic and military strategists of every country on the globe. The importance of our domestic soybean crop in helping to win the last World War is equally well known.

WHITNEY H. EASTMAN

• *Mr. Eastman is president of the chemical division of General Mills, Inc., and formerly vice president of Archer-Daniels-Midland Co., in charge of soybean operations. He organized the National Soybean Processors Association and served as its president for a number of years.*

What are we going to do to safeguard this national asset? It seems to me it has already been demonstrated by our experience with the soybean crop during the past 20 years that this crop has attained a high ranking place in our agricultural and national economy.

Many people are prone to believe that without the two World Wars the soybean industry would never have developed in this country and that it will now shrink back to a relatively unimportant place in postwar years. The simple facts are incontrovertible and refute any such line of thinking.

Prior to the first World War, the soybean crop was already establishing itself firmly in this country, primarily as an additional crop in our agricultural crop rotation program. During the period between the two great World Wars, the domestic soybean industry, under proper tariff protection—to avoid disastrous foreign competition from the cheap labor abroad—grew up in its own right as an important segment of our agricultural economy and as a vital part of our national economy.

It is true that the last World War did provide impetus to the soybean industry much the same as it did for many other industries. But what reason have we to believe that the soybean crop or the industry as a whole will shrink back to an unimportant segment of our total oilseed industry in future years?

Again the economic facts seem unmistakably clear, if we are willing to recognize them and do not try to circumvent them. We must be sure, however, that there are not some obscure or yet unforseen economic or political factors lurking in the shadows of our international relations.

BROAD BASE

The soybean crop has a broad utility base. No other oilseed crop can be utilized for such a diversification of uses. Probably no other oilseed crop affords the same opportunity for research and the development of new and useful products for all mankind. Untold possibilities are at once evident when one realizes that the soybean contains a most unique and unusual combination of protein, carbohydrates, fat, vitamins, minerals, enzymes and phospholipids. This varied composition of the soybean, combined with the easy accessibility of these natural treasures, places soybeans in a pre-eminent position among our oilseed crops as an economical source for several basic ingredients for processed food products and a wide variety of manufactured products for the technical trades.

Assuming that we are not going to permit this country to become wholly dependent upon the other oilseed and nut producing countries of the world for our national requirements of vegetable oils and vegetable protein concentrates either in time of peace or war, what oilseed crop are we going to grow as the one major crop to insure national economic security? The answer seems to point to soybeans.

There are several basic underlying reasons why the soybean crop appears to answer most if not all of the prerequisites for an all-purpose oilseed crop in this country. Soybeans can be grown profitably throughout a rather extensive area in competition with other oilseed crops and our heavy-yielding grain and cereal crops.

Increasing numbers of smart farmers have learned from their county agents, their agronomist advisors, the agricultural colleges and from their own book of experience in growing soybeans over a period of years, that the net returns from the crop cannot be accurately measured by

the price per bushel paid for soybeans in the marketplace at harvest time.

Noticeable benefits are derived from the companion or synergistic relationship of certain crops grown in rotation. Progressive and prosperous farmers, having observed this agronomic phenomenon, have learned to measure their over-all net farm income, not for one single crop or for a single crop year, but for their total farm income for the period of the crop rotation cycle established for a particular farmer in a specific locality.

The crop has proven itself to be the safest oilseed crop from the standpoint of resistance to disease, insect pests and adverse weather and is exceedingly well adapted to our soil and climatic conditions over an extensive area. The soybean is economically well proportioned in its percentage relationship of oil and protein, making it possible for industry to pay producers a relatively high price for soybeans in relation to the value of the finished products.

The oil is an all-purpose oil used to equal advantage in the food and technical fields, and the protein is likewise an all-purpose protein which finds widespread use as food for humans and animals and as a valuable low-cost product in industry. As further unmistakable evidence that the soybean crop has a broad utility value, there has never been a sufficient supply of soybeans to satisfy the demand during the last 20 years.

The use for soybean products, the industrial plants to produce them, and the technology in industry have always kept ahead of soybean production. There are no serious danger signals ahead which would lead us to conclude that the demand for soybean products is going to decline, but on the contrary there is growing evidence and confidence that the demand for soybean products will continue unabated. There is likewise a growing feeling on the part of a widespread group of agricultural and industrial economists that the demand for soybean products will soon exceed the demand for all other domestic oilseed products combined. The feeling is persistently strong that this broad demand for soybean products can be met at price levels which will permit the soybean processor to pay the grower an attractive price.

OTHER CROPS VULNERABLE

On account of the vulnerable position of our three other companion oilseed crops, it seems of major importance that we develop the resources of the soybean industry to the fullest extent.

The domestic linseed industry appears to be extremely vulnerable, and in spite of fabulous subsidies such as crop insurance and crop bonuses, the farmers still refuse to grow flax. The taxpayers are getting tired of protecting this industry. It has long been nurtured and protected by a high import tariff.

It is quite evident that there is a new economic and political philosophy developing in this country in relation to world trade. A growing feeling persists that we should buy from our sister nations the things they can produce cheaper and better than we can in order to balance the world trade ledger. Flaxseed and/or linseed oil may well fit into this category. There are four other countries which are large producers of flaxseed—i.e., Argentina, Russia, India and China. All of these four countries can produce flaxseed much cheaper than we can produce it in the United States. Flaxseed can be grown economically in these countries in competition with other farm crops, whereas, it cannot be grown in competition with other crops in the United States without subsidy, insurance or bonus of one sort or another.

It is a strange agronomic phenomenon that flax should grow as a very clean crop in the other great flaxseed producing areas of the world and yet here in the United States it is probably the most weed-infested of all domestic farm crops. It is without doubt this weed menace that makes flax an unprofitable crop in the United States, and this problem should first be solved if we are to count on flaxseed as an economic oilseed crop in our national pattern. If all the economic factors are counted and evaluated, it might be a lot cheaper for the taxpayer and the consumer if we produce more soybeans and less flaxseed and provide the vehicle for our protective coating materials from the chemical derivatives of soybean oil.

Cotton is primarily a fiber crop, and it does not appear that this crop can be produced economically in this country in excess of our cotton fiber needs. To express the economic problem in another way it does not appear that cotton can be grown in competition with soybeans strictly as an oilseed crop.

Cotton production is increasing rapidly in South America, Africa and Asia, and we cannot hope to compete with these low-cost producing countries for the cotton textile market of the world. Our taxpayers will not stand for it very long if export subsidies are necessary to sell raw cotton in world markets.

The synthetic fiber industry has developed rapidly in this country in recent years and here again is some very real competition for the domestic cotton growers. Under our present form of economy, it does not seem possible that we can count on the cotton crop as our major oilseed crop of the future.

Peanuts rank higher as a rival oilseed crop to soybeans than either flax or cotton. However, there is a long expensive research program ahead before we can ever rely very strongly on the peanut crop as an important segment of our vegetable oilseed industry in this country. Peanuts can be grown profitably as an oilseed crop in South America, Africa and Asia and there appears some hope that modern science will pave the way for the economic development of the peanut industry and that some day we can hope to see a very substantial production of peanuts in the southern agricultural regions of the United States for oil milling purposes.

It seems evident—in fact almost conclusive—that the soybean industry is destined to remain our major oilseed industry in the United States. We must, however, develop a national long-range program, giving full recognition to the fact that the soybean crop has a rightful place in our agricultural and national economy. Government, industry and agriculture must join hands in a concerted effort to develop the industry along sound lines, permitting natural economic laws to function unobstructed, and restraining all political or partisan interests from interfering with the natural growth of the industry.

We must command our full resources and skills in promoting technological development, scientific research and mechanical invention as a means of broadening the markets for our finished products. The economic pattern of the industry is sound, the broad utility of the products of the industry has been acknowledged, but the future of the industry will be just what we make it.

What Can We Do

To Maintain and Expand the Soybean Industry?

By JASPER GIOVANNA

THE GROWTH of our industry cannot be achieved by the chanting of some magic incantations or by the waving of a wizard's wand. It will necessitate arduous, continuous endeavor to break down the obstacles in all the segments of the industry. All of these segments are vitally important and our industry will grow in direct relation to the progress achieved. We need progress in the cultural phase; in the processing and manufacturing; in research and science; and in the consumer channels.

It may seem strange to speak of "maintaining" an industry and then in the same breath of "expanding" it. Why not speak only of "expanding" the industry? To those familiar with the history of the soybean industry, however, the explanation is simple.

In 1934 the United States produced approximately 23 million bushels of soybeans. The 1940 crop was 77 million bushels. In 1943 and again in 1944, during the war years, we reached peak crops of 193 million bushels. The war greatly accelerated an already rapidly growing industry.

This happened principally because hostilities stopped the importation of around 1 billion pounds of fats and oils annually and because war made necessary heavy increases in the production of foodstuffs including meats, dairy products, poultry, and eggs. Without greatly augmented supplies of digestible protein feed the increased production of such foodstuffs would have been a hopeless task.

Where to find the answer to this need for oils and rich protein? Proof of the merits of the soybean was given when it

was chosen to fill this vital need. We all know what an outstanding job has been done. All those connected with the soybean industry can feel justifiably proud, and certainly the soybean grower deserves the thanks of the entire nation for his valiant efforts which were so highly instrumental in our successful war efforts.

With the end of the war a temporary halt to this growth would naturally be expected. As a matter of fact, in comparison with the economic strife and dislocations suffered in the reconversion of many of our wartime industries, the maintenance of our present soybean industry is an achievement in itself.

However, to be satisfied with maintaining our present industry "as is" is not enough. I, for one, am optimistic about its future. Mankind has always appreciated things which sustain life, aid health, and make for comfortable living.

CONFIDENCE DEMONSTRATED

You, the soybean growers have just demonstrated very forcibly your confidence in the soybean industry. In the face of a most disheartening outlook at planting time as to returns you could expect from your 1946 soybean crop in relation to grains, particularly corn, and in the face of widespread publicity given to prediction after prediction that soybean acreage would be cut by one-third—in spite of these ill omens your faith held fast and you planted some 11,600,000 acres to soybeans. True this is down some from last year's acreage, but only moderately so, and if present excellent yield outlook is maintained we can reasonably hope to end up with about as many beans as were harvested last year.

THIS KIND OF FAITH IN THE INDUSTRY in adverse times will do much to expand our industry. For we can only expand by having continuous large crops.

This industry made an excellent growth even during the highly competitive thirties. *Consumers do not choose a product from a field of highly competitive products without good reasons. Soybean products were chosen because of sheer merit.* IT WILL BE THROUGH SHEER MERIT ALSO THAT NEW HORIZONS FOR THE INDUSTRY WILL BE REACHED.

This will not take place simply as a matter of course. It will require hard work, close teamwork by and between all groups in the industry, and also with those friends of the industry closely related to it, some of whom have given it so much in the past. It will require the expenditure of a great deal of money in research and experimentation and continuous arduous endeavor from day to day to culminate in the PROGRESS so keenly desired.

In order to be successful in our desire for growth, *we must create new uses for soybeans.* And more important, we must ENHANCE THE VALUE OF THE SOYBEAN AND ITS MANY PRODUCTS in relation to competing products. John Q. Public, the consumer, must be shown the progress made and the fact that from the soybean and its products he can get best returns for the dollars he has to spend.

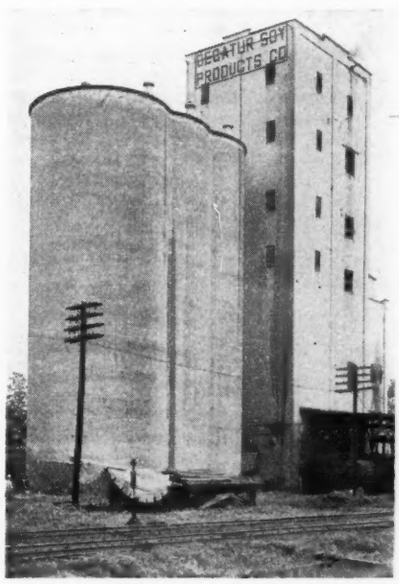
Much of the kind of work needed to expand the soybean industry has been done and is being done by such organizations as our universities. The staffs of the universities have devoted untiring energies far beyond the call of duty to this advancement. The U. S. Regional Laboratories; your own American Soybean Association; the Soybean Research Council; the National Farm Chemurgic Council, our National Soybean Processors Association. These and other organizations are in there "pitching" all the time.

JASPER GIOVANNA

• *Mr. Giovanna was born of Italian parents in Sicily. He is general manager of the Decatur Soy Products Co. and a member of the board of directors of the National Soybean Processors Association.*

Some large companies in addition to lending their support to the programs of these organizations are taking individual steps to further the industry. Some have already made notable progress. One illustration of this is the progress made by Dr. Percy Julian of The Glidden Co. Some of his work is currently explained in an interesting and informative way in the August issue of the *Reader's Digest.* Such companies as the A. E. Staley Mfg. Co. and the General Mills Co. and others are just commencing construction of large pilot plants or research centers. Well known scientists and engineers and their staffs will work constantly in these centers.

Decatur Soy Products Co. plant



Other companies have similar plans or already have them in operation. Many large newcomers have entered the soybean field in recent years and these newcomers are showing a dynamic zeal for finding ways and means of improving and expanding our industry. We are entering a period of strong, tough competition. This kind of competition will serve to spur us on to further technological and scientific achievements. Better efficiency in the growing of soybeans, in the processing of soybeans, and in the manufacture of soybean products will mean expansion of our industry.

These efforts must and will increase. It seems to me that it would be a good thing if the work of the various organizations and individuals could somehow be coordinated—if we could pull together a little better. It seems to me there is not enough contact of the various groups with each other. The processors for instance could make much better use of the facilities and findings of the universities and the Regional Laboratories. We could strive for closer cooperation between the grower and the processors.

I don't know the answer, but perhaps it would be helpful if some kind of soybean council could be set up on a national scale which would embrace leaders of the various groups—the growers, educators, processors, government agricultural experts, scientists, and consumers. Bring these people together at frequent intervals to exchange ideas and coordinate the efforts of all.

In order to expand our industry, in addition to creating new uses for the soybean WE MUST EVOLVE IMPROVED METHODS OF FARMING, breed better varieties of soybeans which will produce more bushels per acre—more bushels of beans that will yield greater amounts of oil and protein.

Our aim must be to lower the cost of producing soybeans in relation to the cost of producing competing crops and at the same time we must so advance technology in processing and manufacturing plants that while the cost of producing the beans goes down we can simultaneously give the consumer more for his money. To achieve this is to assure new fields for the soybean and increase consumption in the existing consumer channels.

BOUNDLESS POSSIBILITIES

The potentialities of some of the new uses of soybean products are immeasurable. In the field of edible uses for instance the possibilities are almost boundless. A great deal of cooperative work has been done in recent months with soybean oil on taste stability. A great deal of progress has been made and much more can be expected. When this problem of taste stability has been fully whipped the field for use of soybean oil will have been widened considerably.

Some new uses for soybean products have been spectacular, and have been given a tremendous amount of publicity. Some of these are: plastics, fire extinguishing foam, plywood adhesives, medicinal uses such as male and female hormones, lecithin, paper coatings, and soybean textiles.

However, we do not want to lose sight of the fact that in spite of all the publicity and attention given some of these newer

(Continued on Page 70)

GERMAN SOYBEAN INDUSTRY

By W. H. GOSS

Northern Regional Research Laboratory, Peoria, Ill.

Figure 1. Part of the wreckage at the mill of Noblee und Thorl.

UNTIL comparatively recent years the soybean industry was confined largely to the Orient, chiefly Manchuria, yet within only three decades it has become firmly established in the Western World. Since the turn of the century, both Germany and the United States have developed mammoth industries based upon the processing of soybeans and the utilization of the oil and meal. The German development preceded our own, however, and much of our technology has therefore been borrowed from that country.

German ingenuity and industry have gained fame in many other lines, and our government felt it desirable to learn as much as possible about recent technological progress in the Reich by sending investigators to follow the conquering armies of the Allies. The author was one of these investigators and was sent to Germany shortly after VE day to study the soybean industry. This assignment automatically included the entire German oilseed processing and oil refining industries, for it is impossible to consider them separately as we would consider the soybean, linseed, and cottonseed industries in the United States.

The mission was sponsored by the technical industrial intelligence committee and entailed approximately 3 months of travelling from one end of Germany to the other. During that time, nearly all the oilseed mills and edible oil refineries, except those in the Russian zone, were investigated, and a series of reports was prepared in which all the intelligence obtained has been recorded. These documents were originally classed as restricted material by the Joint Chiefs of Staffs, but they have since been declassified and are being distributed to American industry in various forms by the publication board of the U. S. Department of Commerce. A private publisher is also assembling them for release as a single book.

1. One of the laboratories operated by the Bureau of Agricultural and Industrial Chemistry, Agricultural Research Administration, United States Department of Agriculture.

The greater part of the investigation was accomplished alone, but a part of the time the author was accompanied by Dr. K. S. Markley of the Southern Regional Research Laboratory, New Orleans, La., to whom he is indebted for the accompanying photographs.

ORGANIZATION OF WAR TIME INDUSTRY

Germany has never produced large quantities of oilseeds within its borders but, instead, has relied upon imports. For this reason, processing facilities are concentrated in seaports and on navigable waterways. The largest installations are on the Elbe River in the Hamburg-Harburg area, which has become famous as the world's greatest oilseed center. These mills processed all kinds of oilseeds, and soybeans were one of the most important, being obtained largely from Manchuria. The same factories, however, also crushed and extracted copra, palm-kernels, peanuts, rapeseed, and numerous other seeds, frequently in the same equipment. Practically all of these raw materials were imported.

Nearly all German installations for processing oilseeds include facilities for refining the oil. The refined products are then sold to margarine factories where they are mixed, usually in the ratio of 60 parts of hydrogenated fat to 40 parts of unhardened oil, with other ingredients to make margarine. This product is somewhat different from the material bearing the same name in this country. It is the housewife's all-purpose fat, used as a spread on bread, for frying and cooking, and for many other purposes. Practically all the vegetable oil processed in northern Germany is so utilized, but in the less populous southern districts considerable amounts of liquid oils are used in cooking. Only minor amounts have been made into products resembling our vegetable shortenings.

• *German processing industry was badly damaged during the war, but the author was still able to learn much from German methods. Dr. Goss, who is an industrial analyst for the Northern Regional Research Laboratory conducted an investigation of the German oilseed industry for the Joint Chiefs of Staff in* 1945.

It is well known that the shortage of edible fats contributed greatly to Germany's defeat in World War I, and extensive preparations were therefore made to avert a similar scarcity during the recent conflict. Huge stores were accumulated, amounting to more than 600,000 metric tons of oil, and these were used sparingly to augment supplies obtained from other sources. Considerable quantities were captured or were made available through the occupation of most of Continental Europe. Also, Germany tried to step up its own domestic production, and the growing of rapeseed was promoted by subsidizing its production through taxes levied on the margarine made from the oil. This crop was grown in eastern Germany on land normally used for raising wheat, and it was planned that the consequent reduction in the production of wheat would be offset by obtaining grain from the Ukraine. This plan failed, however, and the result was a severe blow to the nation's food supplies.

During the early years of the war the Germans imported Manchurian soybeans, as well as peanuts and copra, from Russia. Reports circulated in this country that the Russian government did not fulfill its commitments appear to be incorrect, for records of the German oilseed industry reveal that every order apparently was filled completely and on schedule. No soybeans were available for extracting oil, however, after 1941. The production of soybeans was expanded in Rumania, but the supply obtained from that area was only about 60,000 metric tons per year and was not processed for oil.

Still another source of edible fats was the production of synthetic glycerides from carbon monoxide and hydrogen, two gases obtained from coal. The amounts actually used in foods, however, were quite small.

Animal fats, butter, and many minor sources of fats and oils all contributed to the supply, but food fats were rationed at a very low level throughout the war. Toward the end, the supplies became so small that the population suffered extreme hardships. This serious shortage still exists and, along with scarcities in other foods, has held the population on the verge of mass starvation. At the time of this investigation, the ration allowed each civilian was less than 4 ounces of fats, including butter, per week, but even these slender allotments could not be obtained by most of the population.

PROCESSING OILSEEDS

German oilseed technology differs from that in this country because German mills must handle a variety of raw materials. In general, soybeans are processed by solvent extraction, by use of both batch and continuous types of equipment. Other seeds that contain more oil, are usually forepressed by passing them through expellers one to three times to reduce the oil content to approximately 15 percent. The oil remaining in the residue is then extracted with solvents. This treatment may seem unusual, but it is based upon sound reasoning and is undoubtedly the most efficient method for coping with conditions normally encountered in the German industry.

German expellers are somewhat different from the Anderson expellers and the French screw presses used to process soybeans in this country. The German machines are primarily high-capacity, low-pressure presses designed solely for reducing the oil content of seeds to such an extent that the residue can be processed economically by solvent extraction. Germans do not use their expellers to press soybeans. Hydraulic presses are often employed for forepressing some seeds, and sometimes for finishing in lieu of solvent extraction, but they, too, are not ordinarily used for processing soybeans.

Extractors for treating soybeans with solvents in Germany are of two types, batch and continuous, with the batch type predominating. Many well-qualified technologists still prefer the batch system because it is cheaper and equally efficient in most respects, and it is somewhat more versatile than the continuous systems.

Batch extractors are installed in batteries of about 10 kettles which are filled with expeller cake or flaked soybeans through manholes in the top. The charge rests on a perforated false bottom, and hot solvent is pumped through approximately five of the pots in series. Every few minutes a completely extracted vessel is removed from the line and a freshly filled one is added, using a sequence of operations which affords countercurrent contact between the solids and the solvent. The kettles containing the completely extracted meal are allowed to drain, and the residual solvent is then removed by blowing live steam through the charge while it is being churned by one or two large stirring blades attached to a central shaft. When free of solvent, the meal is discharged through a side door, and the extractor is then refilled and reconnected to the extraction line. Solvent is removed from the oil in apparatus quite similar to that used in continuous extraction plants both in Germany and in the United States. It consists of preevaporators for concentrating the miscella, followed by stripping columns in which practically all the remaining solvent is scrubbed out with steam.

Only two continuous extraction systems are used widely in Germany, and these are also well known in the United States. They are the Hansa-Muhle and the Hildebrandt processes. The first utilizes a chain of baskets which convey the seeds through a spray of solvent, and the second consists of a gigantic U-tube through which the solids are propelled counter-currently to the solvent by means of perforated screw conveyors. There are several other continuous systems in use, but on a much smaller scale.

REFINING EDIBLE OILS

Nearly all of the German refineries for edible oils are located at the oilseed mills, although many of the plants do not have sufficient refining capacity to take care of all the crude oil produced on the premises. The overall process is generally similar to that used in this country, but the individual operations are conducted differently. The first step is neutralization of the free fatty acids, the same as in the United States, but it is conducted batch-wise in kettles instead of continuously. German refiners are opposed to the use of any continuous operations because they feel that more accurate control of quality can be attained by processing individual batches of oil.

After the free acids have been neutralized by reaction with lye, the resulting soaps are washed out of the oil with hot water, the oil is dried by evacuating the tank in which it is held, and the color is removed by introducing activated earth and subsequently pumping the oil through a filter press. The more modern refining kettles have closed tops which permit the use of a vacuum, and the neutralization, washing, drying, and bleaching, therefore, are all conducted in the same vessel.

For producing margarine, it is necessary to hydrogenate about 60 percent of the oil, and this is subsequently mixed with unhardened oil to achieve the desired melting point and plasticity. Before the war soybean oil was used by the Germans chiefly as the "soft" oil, and the "hard" oil with which it was mixed was usually hydrogenated whale oil. In some of the higher grades of margarine, the "soft" oil was peanut oil, and the "hard" fats were coconut or palm-kernel oils or hydrogenated peanut oil. Only rapeseed oil could be obtained during the past few years, during which time the fat in margarine was simply a mixture of hydrogenated and unhardened portions of that oil.

Figure 2. Extraction plant for soybeans at the mill of Noblee und Thorl.

Since prewar soybean oil was used principally as a "soft" oil, its hydrogenation was not practiced on a very large scale as it is in this country. The relatively small quantity that was hardened, however, was treated in equipment quite similar to our own. The end product was quite different, though, because German aims were to obtain high yields of iso-oleic acid, a constituent which contributes to the production of margarine with a suitable plastic range. In the United States the largest part of the hydrogenated soybean oil is used in the manufacture of shortenings, for which purpose efforts are made to produce a minimum amount of the iso-oleic acid.

In producing their neutralized and bleached oils, whether hardened or soft, the Germans deodorized them in approximately the same manner as in our own refineries. The temperatures employed are lower, however, and the operation always is conducted batch-wise.

FLAVOR STABILITY

One aspect of the practices followed in German refineries, and of great interest to the American soybean industry, is the series of precautions and unusual treatments administered to prevent or to delay the development of off-flavors in food products containing soybean oil. Indeed, the investigation of these techniques was a primary objective of the mission to Germany, for there was a decided lack of agreement among American experts on the extent to which the problem of flavor instability had been solved in Germany.

Nearly all German oilseed experts were familiar with the flavor characteristics of soybean oil and were well acquainted with the phenomenon sometimes referred to in this country as "reversion." Two methods for controlling it were discovered, and the results of tests conducted at the Northern Regional Research Laboratory to evaluate one of them have already been described in a paper by G. E. Hilbert.[2] This particular method is applicable only when processing of the soybeans is conducted in accordance with a number of concepts which apparently have been overlooked or ignored by many processors, refiners, and possibly even the growers of soybeans in this country.

To begin with, only the oil from beans of high quality is amenable to the treatment under consideration. The German mills processed Manchurian soybeans for the most part, and these were frequently of low quality or were subjected to damage through heating while passing twice across the equator enroute from Dairen to Hamburg. Such raw materials produced oils which were very difficult to refine and which possessed poor flavor stability. American soybeans, however, were highly prized by the Germans because our own product shipped to that country was of

2. Hilbert, G. E. "Soybean Research at the Northern Regional Research Laboratory." Paper presented at the meeting of the American Soybean Association, St. Louis, Mo., Aug. 28-31, 1946, and published on page 33 of this issue.

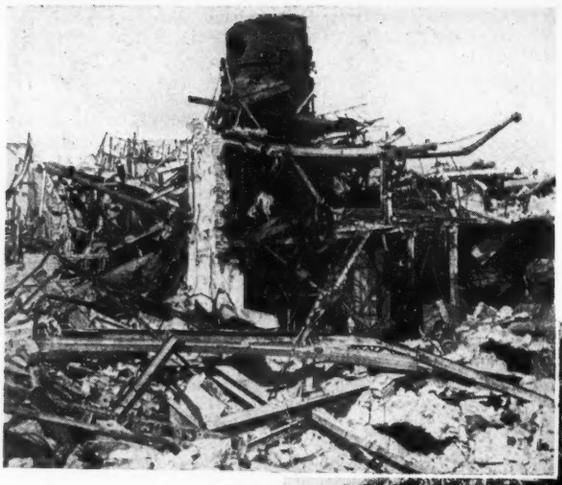


Figure 3. The Tyca extractor used by Noblee und Thorl.

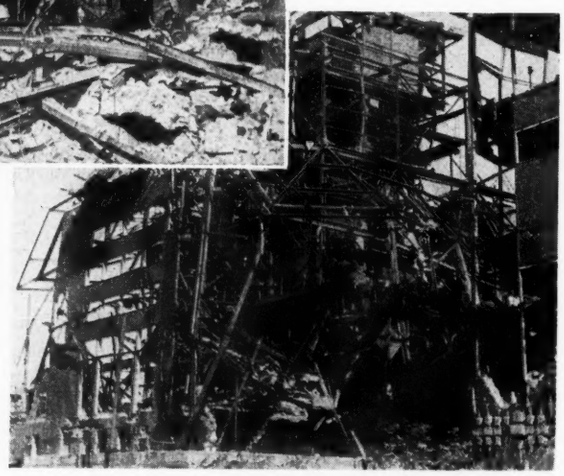


Figure 4. The extraction building of the Hansa-Muhle.

excellent quality and yielded very fine oil.

The second important feature of the technology practised in German soybean mills is that the soybeans must be processed by solvent extraction. Expellers are said to burn the oil in such a way that subsequent treatments are ineffective at preventing reversion. Moreover, the equipment used in the solvent extraction plants for evaporating solvent from the oil, it is claimed, must be constructed in accordance with some principles which appear to have been violated in at least some of the American mills.

The third requisite for the production of good soybean oil is the thorough removal of lecithin. German experts believe that this constituent is the principal cause of reversion, and all of their techniques for retarding reversion are based upon the removal or inactivation of this constituent. It is removed by twice washing the oil with hot water and employing centrifuges to remove the sludges thus formed. Even more washing is administered in some mills. This procedure differs from that used by American soybean processors, most of whom employ no washing whatsoever. Even in those American extraction plants where lecithin is recovered commercially, only one washing is employed, and the Germans say that this is insufficient. Moreover, most of the soybean oil produced in this country is of the expeller type, which, according to the Germans, does not respond to this treatment.

Finally, if the preceding precautions have been observed, it is claimed that the addition of a very small amount of citric acid to the oil while it is being deodorized will impart excellent flavor stability.

Another German recipe for enhancing the flavor stability of soybean oil consists in a special pretreatment of the beans with live steam and, later, subjecting the degummed crude oil to a drastic heat treatment.

SOY FLOUR

As previously stated, the production of soybeans in the Balkans amounted to about 60,000 metric tons per year during the war, and these beans were of excellent quality. They were used almost entirely for feed, seed, and for making full-fat soy flour and flakes. Four factories produced flour and flakes, all of which were sold to the Wehrmacht for use in soups and other foods, and it was an important item in the diet of the German soldiers. The production amounted to 25,000 to 30,000 metric tons of food per year.

Edible flour was manufactured in much the same manner as in the United States, by use of the Berczeller process for debittering the beans. In at least two of the mills, the steaming and subsequent drying of dehulled soybeans was effected in an apparatus similar to a stack cooker. The product was then ground into flour, which represented a yield of 83 percent of the original beans. To make flakes, the seeds were debittered without removing the hulls and were then re-moistened and passed between smooth rolls. In spite of the presence of hulls, the product possessed an agreeable flavor.

EFFECT OF WAR ON OILSEED INDUSTRY

The magnitude of the destruction of the German oilseed industry caused by bombing can be fully appreciated only by actually seeing the ruins. A few plants escaped serious damage, but the majority have been at least partially destroyed. Many are totally wrecked.

The condition of the plants in the great oil-milling center of Hamburg--Harburg was typical. In this region there were four large mills, each processing over 1,000 tons of seeds per day and refining the resulting oil, and there were many smaller mills and margarine factories. Of the four big plants, F. Thorl's Vereinigte Harburger Oelfabriken was the least damaged, being possibly 15 to 20 percent destroyed when hostilities ceased. The damage had been more extensive at various times during the war, but much of it had been repaired. The Harburger Oelwerke Brinckmann und Mergell was about 50 percent destroyed.

The Hansa-Muhle, which was perhaps the most famous soybean mill in the world, was approximately 80 percent ruined. It normally processed 1,000 metric tons of soybeans per day, and its facilities and buildings occupied a large tract of land in the Hamburg harbor district. Its various buildings were destroyed, one by one, in the recurring air raids, but the staff always managed to save the extractors and the still house. During one raid, it is said that flaming oil poured from ruptured storage tanks and completely surrounded the extraction plant, but the fire was brought under control. In a gigantic final raid in March of 1945, however, the still house and extraction plant were wrecked by bombs and burned. The result is shown in Figure 4.

The mill of Noblee und Thorl was probably the largest in Germany, if not in the world, and processed well over 1,000 tons of seeds per day, refining all the oils on the premises. It reportedly received between 2,000 and 3,000 bomb hits during the closing months of the war, and Figure 1 shows some of the resultant wreckage which covers many acres along the waterfront. The destruction amounts probably to about 95 percent. Many of the buildings have been so thoroughly bombed that it is impossible to determine where they stood. Figure 2 is a photograph of a plant used for extracting soybeans, and Figure 3 is a picture of the remains of the Tyca continuous extractor, used by Noblee und Thorl for extracting forepressed peanuts and rapeseed.

The devastation throughout Germany, including that to the soybean and other oilseed mills, is so vast that it is impossible to estimate the time which will be required for rebuilding. It is certain, however, that many years, perhaps generations, must pass before Germany can be restored to the position of prominence which it once held in world trade.

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W. E. RIEGEL, EARLY GROWER, HAS PASSED

News reached the *Digest* at press time of the death from a heart attack of W. E. Riegel, 63 year old Tolono, Champaign County, Ill., pioneer soybean grower.

Mr. Riegel had attended the American Soybean Association convention in St. Louis the last of August and apparently was in good health at that time. He was striken with a heart attack Monday morning, September 2, while riding a tractor, and died late that evening.

Funeral services were held at the First Methodist church in Champaign Friday, September 6.

Mr. Riegel had been growing soybeans for over 30 years. He was associated with another soybean pioneer, the late C. L. Meharry, whose farms he managed. He was one of the organizers of the American Soybean Association. The second meeting of the Association was held in Champaign County in 1921 and he was elected president. He had been active in the Association since.

A more complete account of Mr. Riegel's contributions to the soybean industry will be carried in October.

Large Scale Soybean Production

By H. I. COHN

Poison bran mash is being sprayed from airplane on a soybean field to control grasshoppers on the author's Valley Farms near Carrollton, Ill.

I HAVE been asked to tell you what I know about large scale production of soybeans. If I would start to tell you what I do not know about the soybean you would soon realize, as do those of us who produce beans, that the soybean is so versatile that just when we believe we have found out definitely how the plant will behave under certain field conditions some new talent will express itself and we have to revise our theories.

As a matter of fact, I feel now as I felt some 30 years ago when a professor of field crops at Missouri University as a hypothetical question asked the class, "How many bushels of wheat might we expect from an acre of Marshall Silt Loam soil in a good season?" The professor looked in my direction for the answer. I had worked the previous summer as an assistant in the soil survey and caution regarding statements given to the public had been advised, so hesitantly I suggested, "Wouldn't that vary with the yield?"

And I still do not know the answer either to that or to many other questions on production.

Now as a matter of cold logic I approach the subject of soybean production with a great deal of humility and can pass on only actual observations of quite a few years of rather large scale planting.

BEGINS, ENDS WITH SOIL

This is to be a talk on soybeans but it must begin with and end with the soil, as do all of us. Before trying to produce any crop one must first know his farm, making of every acre an intimate friend. Know their moods and learn their ways. Don't just scratch the surface and expect good results. The soybean is not quite that much of a miracle crop. Let the wild grasses, weeds, shrubbery and trees tell their story. Walk or ride a horse, or to be modern, jar in a jeep, but know and treat your land with the intimacy it deserves.

Watch your fields closely day after day both before and after planting, particularly after heavy rains and you will learn many things that are not in the books. For this type of cooperation your land will be grateful and though there is no mercy in nature yet sound appraisal and cooperation with nature many times produce results that are often attributed by the less observant to luck. For the privilege of cooperating with nature one should indeed consider himself lucky.

Just a few short years ago adaptable varieties were not readily available for many areas. For instance in southeast Missouri and northeast Arkansas the soybean was introduced on a large scale basis not over 8 years ago. In that area Heartsill Banks operating experimental soybean plots at Osceola, Ark., for the Ralston Purina Co. did a masterful job in pioneering. It was from one of Heartsill Banks' plots that I pulled a plant as my pick of the bean with the best characteristics for what I call Cypress soils or soils on which original timber growth was primarily Cypress.

ARKSOY VARIETY

These pioneer Arksoy beans were planted, well inoculated, in 42 inch rows with corn planters using bean plates which dropped the seed about 2 inches apart in the rows, or at the rate of approximately one-half bushel of seed to the acre. These beans grew beautifully and yielded well, several fields over 32 bushels to the acre. I am mentioning briefly the early history of the Arksoy because I want to emphasize the importance of selection of adaptable varieties for an area.

In selecting a variety bear in mind that while soybeans may grow anywhere they will not yield well unless they fit the soil in which they are planted. Some varieties will do well on many soil types, such as the Chief and the Lincoln, while the Richland is not nearly so generally adaptable. In any area you first select the best varieties available and then look for better ones. Fortunately for all of us the colleges of agriculture and the Regional Laboratories in the soybean states are now doing a magnificent job in selecting and refining varieties so that unless we growers have time to devote to selections, we had better spend our time producing as we can safely leave the development of varieties to the specialists.

If you consider planting a large acreage try to pick varieties which possess, among other good qualities, the ability, as many of them do, to mature even when planted "way past bedtime". The cocklebur sets a good example and it may be necessary in some cases to give a Knute Rockne pep talk to your ambitious late planted seeds, asking them, "Why if the 'ornery' cocklebur can always set seed, why can't you"? In a number of cases we have planted Arksoys in southeast Missouri as late as July 15th and they have matured prior to frost. In the Illinois River bottoms we have planted Illini, Chief, Richland, Mukden, and Lincolns as late as July 16th and they have matured prior to killing frosts.

However, when we tried Arksoy seed from southeast Missouri in the Illinois River bottoms a September 28th frost one year caught them flat footed and reduced what looked like a 35 bushel yield to 12 bushels.

In preparing soil, our records indicate that we have obtained the best results consistently by deep plowing followed by thorough preparation, *Plowman's Folly* to the contrary notwithstanding. We work the seed beds as often as possible before planting, in this way naturally reducing the number of weeds we have to try to control after the soybeans are in the ground.

We try to level the fields eliminating low spots. For this purpose we use 18 foot steel drags built on the farm from heavy angle iron. Special leveling machines are available and are excellent where conditions warrant. The more nearly level the fields the more uniform will be the depth of planting, the ease and quality of cultivation and lastly the speed of combining.

As to the best methods of planting there is much room for debate and experimentation. This year 99½ percent of our beans are planted in rows, one-half of one percent are drilled solid. Any width of row that permits cultivating seems to give good results.

BETTER RESULTS WITH CORN PLANTER

We get better results year after year where we use a corn planter than where we use a grain drill with some of the flutes plugged. Our favorite planters are four row corn planters set to plant in about 30 inch rows using bean plates and home-made seed boxes each of which hold about a bushel of seed. Our rates of planting vary from 30 to 70 pounds to the acre.

Planters or drills are carefully gauged before they go into the fields. This gauging is done by use of a seeding rule developed by R. R. Mulvey of the Agronomy Department of Purdue. I used the Mulvey Data in developing a graphic scale which we have found to be extremely helpful in adjusting planters and drills. Use of this data *saves us approximately 1,500*

bushels of seed each year above planting without checking the actual rate at which the seed goes into the ground.

I would like to see some conclusive results on rate of planting. If we plant at the rate of 1 bushel we sow approximately 180,000 seeds to the acre and if all of these plants live and if each plant had only 20 pods of three beans each the yield would be 60 bushels to the acre. As a matter of fact, many plants have over 100 pods and quite a few over 200 pods. With corn we drop two or three grains to the hill and we are extremely careful not to overplant corn because we know that unless we have an unusually favorable season there will be many plants with small ears and we chop or thin out cotton but we crowd beans as we now plant them.

This year we have one field of Lincolns in which part is planted at the rate of 30 pounds to the acre and the balance of the field at 70 pounds. The bean plants at the 30 pound end of the field are larger, stronger and have many more branches, they put on blooms earlier and have more pods to the plant and I am sure will yield well. Last year we planted Lincolns on June 29th and 30th at the rate of 36 pounds to the acre and they out yielded all other beans on the farm. They made 27 bushels to the acre and last year was a year of extremely low average yields for us. We planted Richlands and Chiefs in several fields at 20 pounds to the acre and they yielded better than the average fields planted at the rate of 1 bushel.

We are anxious to obtain new planters, with fertilizer attachments, which will enable us to plant 18 to 20 inch rows at the 1 bushel rate which should give the individual plants room to grow.

REASONS FOR ROW PLANTING

There are many reasons why beans should be planted in rows. Some of these advantages as against drilling them solid are:

1. Less seed required—a saving of from one-half to three-fourths bushels for each acre.
2. Beans stand up better and have stronger stems. (Look at individual plants at edges of fields to see how strong they can get.)
3. Fewer weeds.
4. Earlier maturity. Ten days to 2 weeks ahead of same varieties drilled solid.
5. Earlier combining because of fewer green weeds. Two weeks ahead of solid drilled beans.
6. Higher yield. Five bushels for an average.
7. Fewer weeds for future crops.
8. Cleaner beans at combining time meaning less dock, less trucking and less freight charges.
9. Larger beans.
10. Better seed because more uniform in size.
11. Concentration of plants enables them to crack crust if one should form following rains within a day or two after planting.
12. Stand up much better under strong winds and heavy rains.

While beans planted in 24 inch rows have shown best actual yield results over a period of 11 years with the University of Illinois at the same time 36 inch rows permit planting with corn planter using bean plates and also permit cultivation with the same equipment as is used to cultivate corn, which is a big advantage.

• *The author was one of the early large scale soybean growers in southeast Missouri, at present is a big soybean producer in both Missouri and Illinois. He is operator of the 10,000 acre Fairbanks Ranch in the Illinois River bottoms in Greene County, Ill., and Cypress Farms in Missouri.*

As a matter of fact there is room for a lot of argument as to the proper width of rows. For instance, in 1944, prize yield in the state of Missouri was won by Chiefs planted in 40 inch rows with a yield of 39.9 bushels.

All beans should be inoculated so that the inoculation stays on the seed. It does little good if not in the ground near the young plants but the difference between a good and a bad stand of beans is often caused by failure to appreciate what it means to see that the seed beans carry the inoculation into the ground. Sprinkle the seed lightly with water and the inoculation will stick to the seed. Uninoculated beans are likely to be jade or yellowish green. Seed should always be inoculated at time of or shortly before planting.

Depth of planting varies slightly with soils and moisture conditions but shallow planting, up to but not exceeding 1 inch, is our choice. If the seed bed is dry at time of planting, beans may be planted deeper but shallow planting followed by use of a weighted roller or cultipacker when ground is dry is our general practice.

A rotary hoe follows in a few days, depending on the weather, and condition of the soil. The fields are gone over with the rotary hoe either two or three times and then cultivated with cultivator, usually duck foot or flat type set extremely shallow. Beans grow fast once they get started and for that reason it is difficult to set a fixed rule for handling fields. A visitor asked me how we could handle so many acres of soybeans and I told him we had fixed rules which we proceeded to break every 5 minutes.

WILL STAND EXCESS WATER

Once soybeans are out of the cradle they can take a tremendous amount of punishment in form of excess water. Beans several inches high can survive heavy rains that would drown out corn. Also after maturity beans that have been actually covered with water for weeks can be profitably harvested. About 6 years ago I shot ducks in soybean fields in November, we combined the beans after a heavy freeze in January when they yielded from 12 to 18 bushels per acre. The beans didn't look any too good but they had an oil content by actual test exceeding that of good quality beans. Beans can take punishment, you can take that as a fact.

The soybean is a great pinch hitter, the Babe Ruth of the plant world. It is the greatest pinch hitter I have ever sent to bat. In June 1943 with tremendous odds against us, with our lend-lease arrangement with the Illinois River working in reverse; and with a 10,000 acre lake where the crops should have been, the soybean showed its courage and spirit of cooperation by producing a 17,000 bushel hit. We planted the beans that year by double discing the land as the water went out. Planting the beans solid, farming within 1 vertical inch of retreating flood waters and planting until July 16th we patched in on the higher spots between 800 and 900 acres of soybeans, and they all matured.

Then in 1945 southeast Missouri had torrential rainfall in June which washed out thousands of acres of fine cotton, alfalfa, corn and early soybeans for many farmers in the bootheel. Again the swatking went to bat and again came through with a smashing hit that ran the total of soybeans to an estimated 2 million bushels for the bootheel, pulling out of the mud many farmers. And that isn't all. The alfalfa dehydrating plants fell back on the soybeans and dehydrated soy plant meal made such a fine substitute for alfalfa meal that it is on the first team now. Yes, we planted lots of late corn in the bootheel and corn did what it could but it did not equal the soybean in dollar production per acre nor did corn cash as quickly because the corn was still soft after the beans were sold and many farmers paid for corn shucking with soybean money.

EASY TO HARVEST

Another reason why soybeans are going to continue to increase in popularity is that they are easy to harvest. Two men on one old Holt 16 foot combine and one on a 14 foot self-propelled Minneapolis Moline combined together as much as 1,000 bushels on each of several days. The self-propelled machine is unequalled for work in mud. This machine has operated in fields where the large tires sank over 8 inches in the mud but never once have we had to pull this machine out of a field.

Soybeans make an excellent green manure crop. Plant early and drill solid. Turn under when maximum growth has been attained which is usually prior to September 15th in our area.

Soybeans make good hay and a lot of it but like alfalfa when the entire crop is removed the plant is a heavy soil depleter. If you want hay, drill the beans solid and cut when the pods are small or better yet, watch the stems and cut before they get too woody to make good hay. The yield will be from 2 to 3½ tons to the acre. Any good variety makes good hay. Let the hay cure in the windrow for several days turning with a side delivery rake, and it takes a good heavy rake. Hay can be baled greener than you'd think but test like you would clover and don't bale while too sappy or the hay might mold. The older the hay gets the better the cattle and hogs seem to like it.

Of the many interesting day to day observations made in the bean fields is the manner in which beans of one variety planted at different dates seem to manage to mature at nearly the same time although extreme difference of planting dates may be as much as 45 days. This sounds fantastic but listen to the following observations.

In 1945 our Illinois area had some unusually heavy rains in June which persisted until about the 20th of the month. Here are a few field notes taken on August 23.

1. In a field of Chief beans which were originally planted on May 29 and 30 and in which several low places were replanted on June 25 to 29 the beans planted in May contained many well filled pods on August

23, whereas the beans planted 30 days later contained only small pods.

Field 2. The earliest planted part of this field planted May 28 was in full pod whereas the part replanted July 2 to 6 was in full bloom with only few occasional pods.

Field 3. The beans planted May 29 in this field had large pods at the bottoms of the plants but were still blooming at the tops while beans in the west part of that field, replanted on about June 26-27, were full of bloom with only an occasional pod set.

Field 4. Lincoln beans planted for the first time May 27. They were replanted on June 29-30. These beans were planted at the rate of 36 pounds to the acre and in 30 inch rows. These beans contained many pods 1½ inches long with some pods of 1¾ inches in length. The few rows surviving of the beans planted May 27 were through blooming and contained many well filled pods.

ALL MATURED AT ONE TIME

Amazing as this might seem, when all of these fields were combined in October, all of these plants were equally matured. It was impossible to note any difference in quality or degree of maturity in the seed itself. The late planted beans were not quite so tall, probably a 6 inch maximum difference in height existing and they did not have quite as many pods for an average.

Soybeans require a tremendous amount of calcium and are heavy users of phosphorus and potassium. It is apparent in observing our soybean fields that limestone applied before soybeans has an immediate beneficial effect. This is true because not only is part of the calcium rendered immediately available but the addition of limestone renders more soluble in water a small part of the nitrogen, phosphorus and potassium already in the soil.

A number of years ago I conducted an experiment determining by colorimetric means the availability of water soluble nitrogen, phosphorus and potassium when varying amounts of limestone were added to a slightly acid soil. The results of this experiment showed definitely that slightly more nitrogen, phosphorus and potassium were rendered more water soluble by the addition of limestone and this probably accounts for the fact that phosphorus and potassium applied without limestone many times do not immediately benefit crops to nearly as great an extent when applied singly or together as when limestone is added to the fields at the same time.

Soybeans leave ground loose and for this reason we have had some fields which have not needed plowing for the crop following. Wheat, barley or rye can be drilled on the soybean stubble but yields are not as good as where land is worked.

There have been some experiments on defoliating beans so as to make possible earlier combining. This practice has much merit, particularly where wheat is to follow beans. So far we have not done any defoliating because with row planting, particularly with Lincolns, the leaves drop off early and by the time the pods are ready to combine most of the leaves are gone.

The soybean fits ideally into our farming operations because we plant the beans after corn and harvest them before the corn is ready. In an ideal spring the corn is planted by May 10 to 20 and the beans from then on. If a corn field fails we double cut and drag it and in go the beans. Some farmers prefer to plant beans ahead of corn but we plant about 4,000 acres of corn each year and around 3,000 acres of soybeans, and we have found when beans are planted first the yield may be slightly higher than for beans planted later, but corn planted late seldom makes hard corn, so we much prefer to get the corn in ahead of the beans. A big advantage of planting beans late is that the ground can be worked more often which is a tremendous help in weed control.

Beans are easy to store, they seldom heat because if dry enough to combine clean they will be dry enough to bin.

So far soybeans in our areas suffer little damage from diseases but we must be alert to such possibilities. These diseases cause a small amount of damage but nothing compared to the damage that can be caused by grasshoppers.

Fortunately grasshopper control by use of the airplane is highly effective. In 1944 we baited 1,000 acres with a mixture of bran, sawdust, new lubricating oil and sodium arsenite, in proportion of 40 pounds bran, 40 pounds old sawdust, 4 gallons of new No. 10 lubricating oil and 4 pounds of sodium arsenite in each batch. This oil bait spread by hand can be applied by a man at the rate of only 2 acres an hour, by plane 30 acres in 8 minutes, spreading about 15 pounds of the bait mixture to the acre. This type of control cost about $1.25 an acre for material, time of mixing and airplane. This treatment was so highly effective that 2 years later few hoppers were observed in the area treated.

This year in another part of the farm young hoppers were caught just working into the bean fields from grassways, roadways and ditch banks and were treated to a dose of Chemical 1068, Formula 101A applied by airplane at the rate of 1 pound of the chemical in 2 gallons of water to the acre in form of a fine spray. This new chemical is still in the experimental stage but offers fine possibilities. The kill is excellent but the technicalities of application have to be perfected, particularly with regard to atmospheric conditions at time of application. If the ground is excessively warm the updraft from the heated ground seems to cause the fine spray to dissipate in the air which indicates that early morning application may be necessary for best results.

The most potentially dangerous grasshopper in our area in Illinois is the Differential which is easily identified. He is large and yellow, has almost as many hash marks on his legs as my old army top kick had on his sleeve and he spits almost as much tobacco juice.

If you know your farm, carefully select your varieties, prepare your seed bed properly, apply limestone or fertilizer as indicated, plant in rows, gauge your planter, inoculate your seed, do not plant too deep, use a rotary hoe and duckfoot cultivator you should be able to raise above average crops of soybeans. And remember that the soybean is a great pinch hitter, is a quick cash crop and makes good hay, also that it fits most cropping plans. Now if you have learned something about soybeans I hope that you will be as lucky as one of my Dad's uncles who, after a lifetime of farming was asked by another uncle, also a lifelong farmer, as to what kind of a year he had had, He replied, "Wonderful, I broke pretty near even."

WHAT CULTURAL PRACTICES DO TO SOYBEAN YIELDS

By J. W. CALLAND

Director of Agronomic Research
Central Soya Co., Inc.,
Decatur, Ind.

THE statement has frequently been made that soybeans have only begun their climb toward maximum per acre production. Improved varieties, improved machinery and greater knowledge of cultural practices will all contribute to definitely higher yields.

During the past 2 years our agronomy department, with the cooperation of the extension and agronomy departments of Ohio, Indiana, and Illinois, has tried to check up on the progress being made along this line out on the farms of the soybean growers.

First we had 4,200 farmers in 48 of the principal soybean counties tell us what varieties, machinery and cultural practices they were using, and how these practices affected yields. Then we had 2,000 of these growers tell us how they grew their soybeans in 1945 and what varieties, machinery and practices they were going to use on their 1946 crop in order to find what trends in cultural practices are likely to prevail during the next few years.

Answers obtained in this way are not, of course, the carefully calculated results of well controlled experiments and tests. But surveys of this kind, if the data is collected from a large enough number of farms, will give close to average answers for average management, soil, and weather conditions.

For the purpose of this report I should like to stretch the term cultural practices to include machinery and varieties in our consideration of what cultural practices do to soybean yields.

ROW BEANS VERSUS SOLID PLANTING

In 1944 Illinois farmers planted 58 percent of their beans in rows, 47 percent in 1945, and the average gain in yield per acre for row beans over solid for these 2 years was 1.4 bushels. Their expressed intention was to plant 70 percent in rows in 1946.

Indiana growers planted 45 percent in rows in 1944, 58 percent in 1945, with an average gain of 2.7 bushels for rows over solid. They planned to plant 74 percent in rows in 1946.

Ohio farmers put 9 percent in rows in 1944, 16 percent in 1945, with a gain of 2 bushels for rows over solid. They proposed that 24 percent of their beans would be in rows this season.

The figures submitted by these farmers show a very rapid trend toward planting soybeans in rows, and they indicate that row beans might be expected to give 2 bushels more per acre than solid planting —plus 1 bushel of seed saved at seeding time.

Moreover, row beans give cleaner fields in the fall with fewer weeds to reseed themselves; usually they can be combined several days earlier than solid plantings without waiting for the weeds to mature.

It is well, however, to consider that solid plantings of soybeans have a definite advantage over rows when the problem of erosion is involved. Soybeans planted in rows on sloping land will permit less erosion than corn, but run-off and soil loss can be further greatly reduced by solid plantings on such locations. Drilling soybeans solid is particularly adapted to contour planting which again reduces erosion still more.

Farm experience in regard to definitely less run-off and soil loss from slopes planted in soybeans than from similar slopes planted in corn are fully supported by several years of experiments at Missouri and Iowa and by 1 year's results at both Illinois and Indiana.

CULTIVATING SOLID SOYBEANS

Illinois farmers cultivated three-fourths of their solid plantings. Less than one-half of these fields were cultivated twice. Indiana growers cultivated 40 percent of their solid beans, and gave a second cultivation to one-third of their fields. In Ohio one-third of the solid beans were cultivated with 25 percent of the cultivated fields receiving a second cultivation.

Timeliness is of prime importance in cultivating solid beans. Weeds must be killed while quite young. If wet weather prevents cultivation during this critical period the effectiveness of weed control is likely to be greatly reduced. Two-thirds of the cultivating of solid beans is done with the rotary hoe. The spike-tooth harrow is used in about one-fourth of the cases.

Some good growers say that they plant solid using 2 bushels of seed per acre, but they expect to dig about one fourth of the stands with the rotary hoe, or the harrow, in the process of keeping the field free from weeds. These cultivations not only control the weeds but also stimulate the growth of the beans and increase the water holding capacity of the soil.

With more labor available on farms I believe that more weeds will be killed before solid plantings of soybeans are made and that considerable more effort will be made to keep weeds from getting started in solid plantings.

Secretaries of American Soybean Association

1920-23—W. A. Ostrander, Lafayette, Ind.
1924-26—C. L. Meharry, Attica, Ind.
1927-28—W. E. Ayres, Stoneville, Miss.
1929-30—J. B. Edmondson, Clayton, Ind.
1931 —W. L. Burlison, Urbana, Ill.
1932 —J. B. Park, Columbus, Ohio
1933 —W. E. Ayres, Stoneville, Miss.
1934-35—P. A. Webber, Madison, Tenn.
1936-38—K. E. Beeson, Lafayette, Ind.
1939-41—J. B. Edmondson, Clayton, Ind.
1942-43—Geo. M. Strayer, Hudson, Iowa.
1944-45—Jeanne M Strayer, Hudson, Iowa.
1946 —Geo. M. Strayer, Hudson, Iowa.

WIDTH OF ROWS

There has always been plenty of discussion about how much the width of the rows will affect soybean yields. The figures submitted by the farmers who planted their soybeans in rows seem to me to be quite interesting in this connection. If we class beans planted in rows from 38 to 42 inches apart as wide rows, 30 to 36 inches apart as medium rows and those from 18 to 28 inches as narrow rows, then the figures tell us that narrow rows outyield medium rows by 1½ bushels and outyield wide rows by 3½ bushels.

Sixty-eight percent of the row beans in the three states were planted in wide rows, 15 percent in medium and only 17 percent in narrow rows.

Equipment available for planting and cultivating row beans still largely determines the row width. Many growers doubt if the increase in yield from narrow rows will justify the extra work and bother of trying to adjust their present equipment to plant and cultivate narrow rows. Special bean drills and cultivators do a fine job but they add to investment and upkeep. In many cases the acres of soybeans being produced on the farm will determine whether or not special equipment is justified.

There is a definite trend toward shortening the marker on the corn planter and planting paired rows around and around the field.

At present more than three-fourths of the row beans in these three states are planted with the corn planter, while the remainder is about evenly divided between grain drills and beet and bean drills.

CULTIVATING IMPLEMENTS USED

The rotary hoe is used for three-fourths of the cultivating on solid beans and for more than one-fourth on row beans. The spike-tooth harrow gets the next call for 24 percent of the cultivating on solid and 8 percent on rows. The weeder and cultipacker are used on comparatively few fields either solid or rowed.

The rotary hoe is not only used for one or two early cultivations on row beans before using the regular cultivator, but it is also frequently used back of the cultivator to level the ground and cultivate the rows. The use of the harrow is generally confined to the early cultivations only.

Weeds can be kept down between the rows with one of two cultivations with the regular cultivator but it is the early cultivations with the rotary hoe or harrow that keeps them out of the rows.

SOIL PREPARATION

Eighty-seven percent of all the growers plow their fields for soybeans and their yields are a little more than 1 bushel per acre higher than the yields on land that is disked rather than plowed.

INOCULATION

Eighty-one of each 100 growers inoculate their soybeans. The inoculated fields average one-half bushel higher yield than the uninoculated fields. This is not a large gain but we must consider that a large majority of the fields reported have been in beans before and many were doubtless already well inoculated. It is quite evident that soybean growers feel that the cost of inoculation is so low and the insurance value so high that it is simply good business to inoculate their soybean fields.

SOIL PRODUCTIVITY LEVEL

The kind of soil planted to soybeans definitely affected yields on these farms. There was an average spread of 5 bushels per acre between yields on the dark soil types and yields on the light soils. This effect of improved fertility levels on soybean yields is well supported by experimental results obtained throughout the Cornbelt. While soybeans yield comparatively better than other farm crops on light soils, they also respond well to improved fertility.

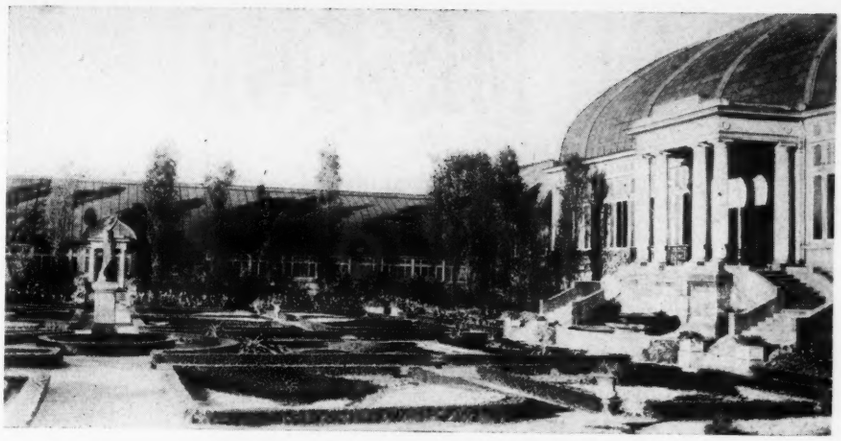
IMPROVED VARIETIES

It may have been true a few years back that soybean growers were not particularly variety conscious, but today they are rapidly becoming so.

A variety survey conducted in Ohio in 1944 showed only one-half of the growers using recommended varieties. Many of the varieties being planted were definitely inferior ones, while others were too badly mixed to be called a variety. Elevators and seed dealers were selling "Manchu type" soybeans to these growers. "Manchu type" was frequently any mixture of yellow beans that happened to be in the bin. Maturity dates might vary as much as 2 weeks among the various beans making up such a lot of seed. About 50 named varieties were being planted in that area.

Fortunately, there is a definite trend throughout the Cornbelt to plant only improved varieties of soybeans. There is also a definite trend on the part of the various states to recommend only the well adapted, improved varieties of high oil content to their growers.

I am sure that as a result of the excellent breeding and variety testing being carried on cooperatively between the U. S. Regional Soybean Laboratory and the various states there will be a steadily increasing demand from soybean growers for improved better adapted varieties. Their desire to buy and plant improved seed is



Many convention attendants visited Shaw's Gardens.

well illustrated by the way they have gone over to planting the Lincoln variety.

These growers reported that while only a little more than 1 percent of their acreage was in Lincoln in 1944, they had raised it to 26 percent of their acres in 1945 and that they intended to plant better than 60 percent Lincolns in 1946. Adams County, Indiana reports that between 80 and 85 percent of their present crop is Lincoln.

TIMELY PLANTING

One of the virtues of the soybean is that it has a long planting season. The yields of the 4,200 growers who reported on the 1944 crop indicate that for that one year, at least, planting date had little effect upon yield for plantings made any time from the first week of May to the last week of June.

Too much weight should not be given to these 1944 planting date results. Time of planting experiments over most of the Cornbelt have indicated better yields from early planting of midseason varieties with a definite drop in yield for planting dates after early June. Early varieties usually give fairly constant yields for plantings made any time in May or June. There is danger of serious damage, however, to seed quality if Earlyana is planted before the latter part of May.

TIMELY HARVESTING

These surveys indicate that the problem of getting soybeans combined on time will largely disappear when more combines become available. One-half of all the growers reporting owned their own combines. Almost three-fourths of the combines owned were the 5 and 6 foot variety. Too many of them still fail to dispose of the straw properly. Soybeans left in the field after they are ready for harvest are frequently subject to severe loss from bad weather.

Now to summarize the effect of various cultural practices upon soybean yields as they were reported by these growers.

1. A well prepared seed bed is good for an extra bushel or more.

2. Planting in rows can be expected to give 2 bushels per acre more than planting solid and in addition saves another bushel of seed. Row plantings are generally cleaner and can be combined earlier. Winter grain can be seeded easier with less interference from straw.

3. Timely cultivating of solid beans can be counted on for about 1½ bushels extra yield, earlier harvest and definitely less weeds on the field.

4. Narrow rows have given 3½ bushels better yield than wide rows and 1½ bushels more than medium rows.

5. Inoculation will pay well on many fields and is good insurance on most fields.

6. Well adapted improved varieties may be expected to raise yields about 20 percent, if we can use Lincoln as a yard stick.

7. Improved soil productivity through the use of lime, fertilizer, manure, crop residues and clover will add 4 to 6 bushels per acre.

8. Timely harvesting may save several bushels per acre.

If all of the best practices as indicated by the reports of these growers were to be practiced by all soybean growers, it appears that the average soybean yields of Ohio, Indiana and Illinois could be increased from the present 18 to 20 bushels per acre to somewhere between 25 and 30 bushels per acre.

But to prevent anyone from thinking that raising state soybean yields between 5 and 10 bushels per acre is just that simple, I feel that I should mention some of the things about which soybean growers are going to want more factual information and also two or three other things they will want to see brought about.

FIRST

Now that growers in Ohio, Indiana, Illinois and Iowa are making Lincoln their standard midseason variety they are asking for two more improved varieties. The first one is wanted to replace Richland. It must have Richland's maturity and stiffness of straw, must grow several inches taller than Richland and have the seed quality, yield and oil content of Lincoln with some added disease resistance. For the sake of a name they might like to call it the Jefferson.

The second variety wanted is mostly for the northern areas of these states and is particularly wanted by the large number of growers who wish to follow soybeans with wheat. This variety must mature 10 days earlier than Richland but must have the same sterling characteristics of height, stiffness of straw, quality seed, high yield and oil content of Lincoln and Jefferson. I think they would be willing to call it the Washington.

SECOND

One grower out of five in Ohio and Indiana fertilizes at least part of his soybeans and fully two-thirds of these report good results from the use of fertilizer. Only one grower in 15 reports the use of fertilizer in Illinois and practically none use it in Iowa.

In general they are told that fertilizer applications on soybeans will not pay except on soils where the soybean plant shows signs of nutritional deficiencies. Their own experience checks fairly well with this. However, they see their other crops respond well to direct fertilizer applications and they see soybeans respond well to increased fertility levels. I think they would like to know more about how the soybean plant feeds, how it takes up its nutrients, so they could induce it to make better use of direct fertilizer applications.

THIRD

As farmers become more soil conservation minded they would like to have more experimental data on the relation of the soybean crop to erosion. They are frequently told that the soybean is a special offender in inducing erosion. But they have observed less run-off and soil loss from their soybeans than from their corn fields. I think they would like to have more actual comparative figures on the soil loss and run-off from soybeans, corn and other crops—more data on the erosion control value of a winter cover crop following corn and soybeans—also soil losses from spring crops following corn and soybeans—more information on the physical effect of the soybean crop on soil structure.

FOURTH

They would like to know more about the effect of the soybean crop upon soil productivity, its effect on the yield of other crops in the various rotations—more about the chemical effect on various soils.

FIFTH

They would like more flexibility in corn planting and cultivating equipment so that this equipment would better satisfy the cultural needs of the soybean crop.

SIXTH

Increased research aimed at developing both new products from the soybean and extending the use of present products.

SEVENTH

Removal of unfair legislation, rulings and restrictions against the use of soybean products in food.

EIGHTH

Increased national realization that the Cornbelt can produce more food from an acre with soybeans than from any other crop. That the soybean is the logical crop to supply our increasing needs for vegetable oil and protein, and that it is the most versatile crop on the farm.

• *Mr. Calland for a number of years has been conducting an extensive survey of soybean cultural practices in the Cornbelt. He has had experience as farm manager for* 15,000 *acres of land.*

SOYBEANS IN MISSOURI

By A. W. KLEMME
Extension Professor of Soils
University of Missouri

IT IS A DISTINCT honor to have the opportunity of addressing this 26th convention of the American Soybean Association here at St. Louis. It gives me much pleasure to report to you that at this date soybean seed as a cash crop is out ranked only by wheat and cotton in value. In recent years the income from this crop has paid the mortgage on many farms. The increasing importance of it is shown by acreage and production reports of the Bureau of Agricultural Economics.[1] Soybeans have come into prominence as a seed crop in Missouri only recently.

During the three year period 1943-1945 inclusive, the average annual acreage harvested for seed was 632,000. The average yield was 15.1 bushels per acre giving a total annual production of 9,576,000 bushels. About 150,000 acres were harvested for hay, grazed or plowed under as green manure. The acreage grown for hay was less than one-fourth that grown for seed. The estimate of this year has it that 606,000 acres will be harvested for seed in 1946 with an average yield of 17 bushels per acre and a total production of 10,336,000 bushels.

During the 12 year period 1931-1942 inculsive, only 147,000 acres of soybeans were harvested annually for seed. The average yield per acre was but 10.4 bushels giving an annual production of 1,678,000 bushels. The balance of the crop or about 377,000 acres was harvested for hay, grazed by livestock or plowed under as green manure. During this early period of this crop the acreage grown for hay was two and one-half times that grown for seed. While soybeans were then hailed as a hay crop but not as a seed crop, the present acreages now bear them out as a seed crop but not a hay crop. During the years of the last war the Missouri farmers increased their acreage of soybean for seed over 300 percent. They increased their yields per acre 47 percent or by 4.7 bushels per acre. This extra 4.7 bushels per acre was obtained with little or no extra labor. It made the production of the crop profitable.

WHY OF BETTER YIELDS

This increased yield per acre was obtained through the use of improved varieties, better cultural methods and soil improvement practices.

The American Soybean Association, the Agricultural Experiment Station, and extension service of the Missouri College of Agriculture, the railroads, processors, farm organizations and many other groups and individuals helped to bring about the wide use of these improved practices which resulted in these increased acre yields and the important place the soybean now holds in Missouri agriculture.

For example, as early as 1932, A. F. Stephens, an agricultural agent for a railroad, distributed well-adapted yellow seeded varieties to leading growers in northeast Missouri. In recent years he has assisted in getting soil improvement practices adopted by the growers.

A map of Missouri showing where the soybeans were grown in 1943 and 1944. Each dot represents a production of 10,000 bushels. From Missouri Circular 300—SOYBEAN SEED PRODUCTION IN MISSOURI.

The above figures of acreages and yields show that soybeans have become an important crop in Missouri. Farmers like the crop. It is easy to grow, and fits well in rotations with other crops. Little or no extra farm machinery is required to grow and harvest it. Soybean oil meal is an excellent protein concentrate feed for livestock which many farmers have learned to use. Excellent yellow seeded varieties capable of producing high acre yields are available. Even better ones are being developed. There are, according to King[2], approximately 3½ million acres of land in Missouri of level to gently rolling topographical features that are especially well suited for the production of soybeans. These soils consist of the level to gently rolling claypan soils of northeast Missouri and the lowland areas of southeast Missouri which now produce three-fourths of the present production. Similar soils occur in numerous other areas in different sections of the state. Chief among these are the heavy clay or "gumbo" soils along the Missouri and Mississippi Rivers and other streams and the southwest Missouri prairies.

Most of these soils are drouthy and unable to meet the fertility needs of a full crop of corn. They are considered better suited to the more drouth resistant soybean which begins growth somewhat later in the spring when these soils are better aerated. They begin to release their soil fertility at the time when the soybeans can use it.

Since these soils are unable to meet the fertility requirements of a full corn crop they cannot be expected to meet the requirement of a full soybean crop. Soybeans draw as heavily on the soil for fertility as does corn. For example, a 25 bushel soybean crop requires one-third more nitrogen, twice as much calcium, one-seventh more phosphorus and nearly as much potash as a 60 bushel corn crop.

YIELDS MUST GO HIGHER

For the soybean to hold its present position or to gain in importance in Missouri agriculture, it must compete with other crops. In order to compete with other crops, annual acre yields must go higher. The principal limiting factor to higher acre yields is a low soil fertility level.

The soybean[3], was a native of Southeastern Asia and was cultivated in China and Japan since long before written records were kept. In its survival through the ages it has developed a wide range of adaptability. It can withstand short periods of drouth. Wet season does not seriously retard growth or decrease yields. It is less susceptible to frost than is corn or cowpeas. It will produce forage and some seed on soils so depleted in soil fertility that other legumes such as clover and alfalfa fail.

This wide tolerance that this crop manifests to factors and conditions that seriously retard growth and limit yields of other crops has overshadowed the fact that high acre yields of soybeans require a fertile soil. Manchuria, known as "the Land of Beans" is in the latitude of the Dakotas, has cold dry winters and warm summers with enough of rain in May and June to start the crop in the mineral-rich soil prevailing there.

Prior to World War II, soybeans were grown primarily as a hay crop on land where clover failed. Fairly satisfactory yield or tonnage of hay was obtained which fact caused the soybean to be considered by many farmers and others as a "poor land" crop. However, even with the use of the improved, higher-yielding, yellow-seeded varieties, the seed yields on such soils were low and unprofitable.

Soils of low fertility may be able to release sufficient fertility to build the skeletal framework of a plant. After that is once formed, the plant can seemingly substitute elements of the atmosphere for some of the deficient soil-borne nutrients and continue growth by producing woodlike vegetation or tonnage of lower mineral and protein content than forage grown on a fertile soil.

Seed, which is relatively stable in its composition, is formed after most of the vegetative growth has been produced. The amount of seed that can be produced depends largely on the amount of soil nutrients assembled by the plant both before and while the seed is being formed. Should the supply of a single soil nutrient be less

1/Computed from Missouri Farm Census by Counties 1943-1944; Reports of State Statistician; Agricultural Statistics 1945, United States Department of Agriculture.

2/B. M. King, Soybean Seed Production in Missouri—Missouri Circular No. 300.

3/Climate and Man—1941, U. S. Year Book of Agriculture.

(*Continued on page* 68)

Soybean Research at the

Northern Regional Research Laboratory 1936-1946

By G. E. HILBERT

Director, Northern Regional Research Laboratory[1], Peoria, Ill.

THE SOYBEAN, within the past 15 years, has become one of the cornerstones of Midwest agriculture. Concomitant with this development has been the establishment of the large soybean oil processing industry. Utilization of the products of the soybean in the food, feed, and industrial fields is now of major significance. Expansion of soybean production during the war years prevented that national shortage in oil and fats from assuming calamitous proportions.

During the past 10 years the U. S. Dept. of Agriculture, specifically the Bureau of Agricultural and Industrial Chemistry of the Agricultural Research Administration, has devoted a great deal of attention to the development of new and extended uses for soybeans. In 1936 the U. S. Regional Soybean Industrial Products Laboratory was established at Urbana, Ill. The chemical and engineering research of that laboratory was transferred by an act of Congress from Urbana to the Northern Regional Research Laboratory at Peoria in July 1942.

Removal of part of the laboratory to Peoria has resulted in an expansion of all phases of soybean research. Dr. Reid T. Milner, formerly director of the U. S. Regional Soybean Laboratory and now head of the analytical and physical chemical division of this Laboratory, is the liaison officer to initiate and maintain contacts with soybean agronomists and breeders in the state experiment stations and the Bureau of Plant Industry, Soils, and Agricultural Engineering on the one hand and with industry on the other. The research group under his supervision has been actively studying methods of analyzing soybeans and derived products.

Technological and fundamental research on soybeans is being carried out by the oil and protein division of which J. C. Cowan is in charge. This group is concentrating practically all its activities on soybean oil and meal. Most of our new developments originate in this division. Our engineering and development division, the head of which is C. T. Langford, is conducting the large-scale operations on the processing of soybeans and on the translation of laboratory developments to a pilot-plant scale. This division obtains cost data and evaluates the economic feasibility of the developments.

In addition to these three groups, three other divisions have given some attention to soybeans. The fermentation division, headed by A. F. Langlykke, has examined the conversion of soybeans to soybean cheese and soya sauce. E. C. Lathrop, head of the agricultural residues division, has focused attention on the use of soybean stalks in the production of corrugated strawboard, and J. H. Shollenberger, head of the commodity development division, is responsible for the collection of production figures and economic information on soybeans and their various products, thus permitting us to follow and anticipate changes in the broad market situation and to adjust our research program accordingly.

With the aim of increasing the demand for soybeans the program of research at the Northern Regional Research Laboratory has been directed toward:

1. The development of new, or the improvement of known, methods for separating the oil from the seed.

2. The elimination of the flavor instability of soybean oil.

3. The improvement of flavor and color of soybean oil meal so as to produce a more acceptable food product.

4. The development of new industrial raw materials, resins, adhesives, and lubricants from the soybean.

5. The modification of soybean oil to increase its utilization in the paint and varnish field.

I will now describe the progress that has been made in the past 2 years and our current program. In particular, I will touch upon the work we have done on precise determination of the oil content of soybeans, alcoholic extraction of soybeans, flavor stability of soybean oil, Norelac, soybean oil paint, new industrial materials from fat acids, plywood adhesives, and use of soybean stalks in corrugated strawboard.

Recent studies of the Northern Laboratory include alcoholic extraction of soybeans, flavor stability of the oil, plywood adhesives and oil drying qualities. Dr. Hilbert has been with USDA for 15 years, was head of the starch and dextrose division of the Northern Regional Research Laboratory before his appointment as head of the Laboratory last winter.

PRECISE DETERMINATION OF OIL CONTENT

The new physical instruments and methods recently developed by Dr. Milner's group now make it possible to analyze vegetable oils for their constituent fatty acids with accuracy and comparative ease. The physical chemists of the Northern Laboratory have assisted in developing and improving these new methods. Working in close collaboration with the American Oil Chemists' Society, studies on methods of refining tests for soybean oil have been successfully carried out in order that a fair price may be set on this important article of commerce.

With cooperation from a large soybean processor, a long term study of possible changes in composition of soybeans during storage has been undertaken.

One of the most important contributions of Dr. Milner's group has been to assist in the setting of standards for the more precise evaluation of oil content in soybeans. When marketing of the entire soybean crop was undertaken by Commodity Credit Corporation in September 1943, a chaotic condition resulted from the attempt to fix the price of soybeans by determining their oil content. The Commodity Credit Corporation, the National Soybean Processors Association, and a special advisory committee of the American Oil Chemists' Society requested our assistance in setting up a uniform analytical method for determining oil in soybeans. This laboratory coordinated research carried out on the analytical method, and sent out a series of standard soybean check samples to over 80 laboratories conducting these analyses.

As a result of the experience gained and improvements in the method achieved, this marketing program of the Commodity Credit Corporation (now Production and Marketing Administration) has steadily improved. As now administered by R. T. Doughtie, Jr., of the Production and Marketing Administration, the analytical results are rarely questioned, and there is general satisfaction with the entire program.

There is sentiment on the part of some for continuation of this pricing procedure for soybeans after the present gov-

1. One of the laboratories of the Bureau of Agricultural and Industrial Chemistry, Agricultural Research Administration, U. S. Department of Agriculture.

ernment marketing program has been closed.

ALCOHOLIC EXTRACTION OF SOYBEANS

Two processes are being utilized industrially to separate the oil from soybeans. One involves the use of heat and pressure and the other extraction by means of petroleum solvents. The oil meal ordinarily produced by these two processes, in general, is colored and unpalatable to some people.

Because it was known that alcoholic extraction of soybeans leads to a palatable meal, a program was initiated by A. K. Smith, A. C. Beckel, and P. A. Belter of the Northern Laboratory to develop an economically feasible method of separating the oil by means of alcohol. Such a method, for operation on a continuous basis, has now been developed and perfected.

Experimental work has demonstrated that food products such as bread, meringues, whips, and candies containing this alcohol-extracted soybean flour are superior in flavor and color, and are equal nutritionally, to similar products prepared from commercial soybean flour. Protein derived from alcohol-extracted flour and useful in fiber production and paper coatings is whiter than the analogous product prepared through extraction of the beans with petroleum solvents. Additional studies on the utilization of this alcohol-extracted meal and the derived protein are under way.

In cooperation with an industrial company, this alcohol-extraction process was translated to a pilot-plant scale in order to obtain data necessary for engineering design. Through this joint endeavor it was found that the solvent, alcohol, could be reclaimed by a cooling rather than a distillation process. Operation of a plant utilizing this process is expected to lead to increased yields of oil and the production of highly palatable soybean flour. Of added significance to agriculture is the use of a solvent derived from farm products instead of from petroleum.

FLAVOR STABILITY OF SOYBEAN OIL

One factor which limited the use of soybean oil for edible purposes prior to World War II, and which will limit its consumption after the world supply of vegetable oil becomes more abundant, is the flavor instability of the oil as well as various products made from it, such as salad oils, margarine, and shortening. As compared to competitive food oils, soybean oil suffers from the disadvantage of rapidly developing a grassy or painty flavor on standing. This change in flavor has usually been called "reversion."

The solution of this flavor problem is perhaps the most important one facing the soybean industry. It must be overcome if the gain in the amount of soybeans utilized during the war is to be maintained or if the demand for soybeans in the future is to increase. A solution to the problem will not only enable soybean production to continue on a greatly expanded scale but should also increase substantially the market value of the crop.

A systematic research program with the aim of increasing the flavor stability of soybean oil has been undertaken, and the work has been under way for 2 years. One of the difficult problems which faced us in organizing this program was that of measuring the change in flavor of oils during storage. It is well known that no single chemical test or even a series of such tests, can measure satisfactorily the kind or degree of flavor in aged soybean oils.

The most precise method, and this leaves much to be desired, is that of tasting. In organizing our tasting panel, advantage was taken of the experience of industry in this field. Sixty members of the Laboratory were screened from the standpoint of sensitivity and reliability in detecting types and degree of flavor. The panel now consists of 12 scientists, with 10 alternates. The flavors of the oils under investigation are scored by the tasters and the results analyzed by a statistician. In this manner the error due to the variability of the human element has been reduced to a minimum. The judicious use of these tasters as analytical tools has enabled us to measure with confidence improvements effected in flavor stability of the oil.

Progress made on this problem of flavor reversion was accelerated through information gleaned in Germany. In the summer of 1945, W. H. Goss, one of the soybean experts of the Northern Regional Research Laboratory, and who later in this program will describe for you his experiences in Germany, was loaned to the technical industrial intelligence committee of the Foreign Economic Administration to investigate the German vegetable oil processing industry. His thorough and methodical investigation of practically all the companies processing vegetable oils in Germany disclosed that the Germans had apparently developed a number of methods which were claimed to produce a practically stable soybean oil. In view of the circumstances under which some of this information was obtained, Mr. Goss believed these processes had merit and were not merely manufactured in the minds of the German oil experts during the stress of the interviews.

Shortly after this technical information became available, J. C. Cowan and H. J. Dutton, who are in charge of the soybean oil flavor program, subjected one of these German methods to careful examination. They first studied the application of the German technique for improving the flavor stability of refined, unhardened soybean oil. Their work is now being extended to investigate the effectiveness of the method when used in the production of shortenings.

G. E. HILBERT

The results thus far obtained indicate that the one German method which we have under investigation yields a soybean oil in which the development of objectionable flavors is retarded to a very considerable extent. When the refined oils used in these tests were stored at room temperature, for example, those which received the German treatment required more than four times as long to develop disagreeable flavors as did those which were similarly refined without use of the special technique.

This improved soybean oil can be prepared cheaply and easily by appropriate processing of solvent-extracted oil, but apparently not from the expeller type of oil. A number of other features of German oilseed technology, which appear to have merit, are also under investigation.

In order that industry could take advantage of these findings, the results of our work were disseminated to the soybean industry at a meeting of the Soybean Research Council last April and at the annual meeting of the American Oil Chemists Society in New Orleans in May. These results have aroused the interest of industry and stimulated research activities and processing investigations along similar lines. A cooperative program for translating our results to a pilot-plant scale is being developed between the Laboratory and one of the large soybean oil refiners.

The ultimate significance of this work to the American farmer and the soybean industry is difficult to gauge at this early stage in the development. There can be little doubt, however, but that it will place soybean oil in a more favorable competitive position with respect to other food oils and tend to reduce the price differential that has existed between them; and any such change will be reflected in enhanced returns to the growers.

NORELAC

Two years ago H. T. Herrick, the former director of the Northern Regional Research Laboratory, reported on the development of a new type of synthetic resin, called Norelac, from soybean oil. This product was shown to have considerable promise as a protective coating and as a heat-sealing and moisture-proofing agent. Work on this project has been completed. Two concerns, in the meantime, have translated the laboratory process for producing the resin to a semi-commercial scale. One of these companies is now planning to erect factory-scale production facilities.

SOYBEAN OIL PAINT

Soybean oil by itself is a poor paint oil. For many years it has been used as an extender of good drying oils. Industry has devoted a great deal of attention, without much success, to the development of procedures for improving the drying properties of soybean oil. During

(Continued on Page 72)

Soybeans and The Fertility Level

By A. G. NORMAN

Iowa Agricultural Experiment Station

THE SOYBEAN is a relatively new major crop in Iowa that brought with it many questions relating to proper land use to which full answers were not available. A newly introduced crop will establish itself only if it is well adapted to the soil and climate environment of the region, if it can compete economically with the existing crops, and if it fits into and does not disrupt the crop sequences that have to be used to obtain maximum yields of the other crops.

THE SOYBEAN CORN YIELD RELATIONSHIP

The future acreage of soybeans in this state (Iowa) will depend largely on the demand, and the price and yield relationships with respect to corn. The support prices of the past few years and the general yield relationship in Iowa have been somewhat to the disadvantage of the soybean. Demand for both corn and beans is presumably likely to remain strong for some time yet.

Ultimately, however, when oils and fats are in better supply, there may well be a substantial reduction in soybean acreage. We ought then to be in a position to say on what soils or under what conditions may soybeans be most efficiently grown, particularly with respect to corn. The reduction in acreage, which perhaps may be said to have started this season, will not and should not amount to a uniform thinning. In 1944 there were about 5.5 acres of corn for each acre of soybeans in the state; this season the ratio is over 7.

For the past five seasons the general yield relationship between corn and soybeans has been 3.6 bushels of beans for every 10 bushels of corn. A study of yields by seasons and by counties shows that the spread on both sides of this figure is considerable, and that there are counties where, over the 5-year period, the relationship has been as low as 2.7 bushels and as high as 4.4 bushels of soybeans per 10 bushels of corn.

Obviously, in any acreage reduction, other things being equal, it will be more profitable to retain soybeans in those areas where the yield is high with respect to corn. These, however, are not necessarily the areas in which the soybean yields are highest, and accordingly there must be a compromise between high yield and high yield relationship with respect to corn. In table 1 is tabulated the soybean-corn relationship for the 10 high and low-yielding counties.

The adaptation of soybeans and corn with respect to the combination of soil and climate are not identical. The highest yields of soybeans have not completely coincided with the highest yields of corn even though these crops have largely been put on the same land. The lowest yields of these two crops have usually been in entirely different parts of the state. In general, the high soybean yielding counties are in the southeastern and east-central part of the state and only partly coincide with the high corn yielding counties. The low soybean yielding counties have in most years been along the Minnesota line and in the northeastern corner of the state. Low corn yields on the other hand always are found in southern Iowa along the Missouri line. This again indicates that the soil and climatic adaptation of corn and soybeans are not identical and that the varieties widely grown at present are not fully adapted to the state as a whole.

There is, of course, no reason why corn and soybeans should be expected to have precisely the same adaptation, but up to the present in our thinking and our programs we have tacitly regarded them as so. The season is apparently too short in the northern part of the state for maximum yields with present varieties. In the southern part of the state, other than in a few counties toward the southeast corner, yields are limited by poorer soil conditions, and in the southwest by lower rainfall.

In Des Moines, Henry, Washington, Jefferson and Keokuk counties the soybean corn yield relationship (almost 4.2) is favorable to soybeans and the yields have been about 20 percent above the state average. In this area there has been as much as 1 acre of beans for every 2.7 acres of corn. Further to the north and west (Scott, Cedar, Tama, Marshall and Grundy counties) where yields have been almost as good, the yield relationship to corn (3.6) is not quite so favorable since these are also top corn yielding areas.

If, however, we look at the areas in which production has been heavy, that is the counties with largest acreages, we find that these lie in the north central part of the state, from Des Moines north. In this area the bulk of the beans have been produced, and for this area as a whole the soybean-corn yield relationship is about 3.5 bushels of beans per 10 bushels of corn.

With this analysis before us it will be seen that if the future acreage of soybeans depends primarily on the price relationship with corn it is likely that the reduction will be proportionately greatest in the western and northeastern counties. It may well be that soybeans will largely disappear from these areas. Next there is likely to be substantial reduction in the north central part of the state especially towards the Minnesota line. In the southeastern counties, and particularly in those listed earlier, the soybean acreage is more likely to be maintained.

In order to be a competitive crop every effort should be made in all areas to obtain maximum yields. This should include planting the best varieties, greater attention to weed control, and general use of narrower row spacings, and greater attention to the fertility relationship of this crop.

RESPONSES TO GOOD MANAGEMENT PRACTICES

In this survey corn yields have been taken as the fertility yardstick against which the soybean crop has been judged, and it appears that, due to differences in adaptation to climate and soil, the soybean crop responses do not entirely parallel those of corn. However, locally the situation is different and here the evidence which has been accumulated does indicate that the soybean crop responds as well to high levels of soil productivity as does corn. Pierre (*Soybean Digest*, April, 1944) reported studies on the Agronomy Farm at Ames, where in a 4-year rotation soybeans were substituted for corn on half of the plots. Where treatments of lime, phosphate and manure had been applied so that on the average the corn yields were 41 percent higher than on the check plots, soybean yields were found also to be 41 percent higher. These experiments have been continued and the conclusion then reached is now fully substantiated.

It is interesting to note that seasonal effects on the two crops are so similar. The implications of this are that there is no case for relegating soybeans to the poorer land under the mistaken impression that corn responds much better. It is doubtful in fact if this belief has been held in Iowa in recent years.

EFFECTS ON FOLLOWING CROPS

Long-time rotation experiments provide the means of determining direct and indirect effects of one crop upon another. The information is obtained slowly, and as yet our newer rotations that have included soybeans have not gone through sufficient cycles to form the basis of any generalizations. Enough has, however, been done to be sure that the soybean crop makes no excessive demands on the supply of soil nutrients. Almost all beans in Iowa are row planted, so that as an intertilled crop there are certain effects on the soil organic matter, and certain precautions against erosion have to be taken on rolling land similar to those with corn. Norum (*Farm Science Reporter*, January, 1943) reported several years ago comparisons of corn yields following soybeans and corn, in

which it appeared that, on the Clarion and Webster soils of the north central part of the state, corn following soybeans outyields corn following corn by 8-9 bushels. This has been extended by C. A. Black to a total of 39 fields in the north central and western counties. The average for all fields is 65.5 bushels for corn following corn and 74.3 bushels for corn following soybeans, a difference of 8.8 bushels. In some instances the differential was quite large, particularly on the finer-textured soils. It is his opinion that these increases can be attributed largely to the favorable effect of soybeans on soil structure.

Similarly on the Agronomy Farm at Ames the same comparison has been made on 24 plots in a 4-year rotation. The mean difference in 1944 and 1945 was 7.3 bushels in favor of corn following soybeans. This difference seems little affected by the fertility level though affected by season.

The effect of soybeans on other crops in the rotation has not been studied so fully. We have a number of experiments at several locations in which corn or soybeans have been followed by small grain. All that can be said of these is that oats following soybeans have never yielded less than oats following corn but that significantly greater yields, though sometimes observed, have not been consistently or generally found. Additional trials with the new high yielding oats that have a heavy demand for soil nitrogen might be worth while.

Table 1: Soybean-corn yield relationship for 1941-1945 inclusive.

Group	Soybeans bu./acre*	Corn bu. /acre*	Soybeans bu. per 10 bu. corn
A—10 counties with highest soybean yield	22.6	58.5	3.9
B—10 counties with lowest soybean yield	14.7	46.9	3.1
C—10 counties with highest corn yield	20.7	60.4	3.4
D—10 counties with lowest corn yield	15.6	38.9	4.0
State average	18.7	52.2	3.6
Typical of Group A—Henry Co.	23.7	54.5	4.3
Typical of Groups A and C—Grundy Co.	23.2	62.7	3.7
Typical of Groups B and D—Howard Co.	11.8	39.7	3.0
Typical of Group C—Marshall Co.	22.4	62.5	3.6
Typical of Group D—Wayne Co.	15.6	35.4	4.4

* Unweighted mean of acre yields for seasons 1941-1945.

Table 2: Comparison of the effect of soil fertility level on yields of corn and soybeans (Webster silt loam—Agronomy Farm, Ames, 4-year rotation).

Yields in bushels

Soil Treatment*	1942 Corn	1942 Soybeans	1943 Corn	1943 Soybeans	1944 Corn	1944 Soybeans	1945 Corn	1945 Soybeans	1942-1945 Corn	1942-1945 Soybeans
None	76.9	25.6	61.4	23.4	55.3	26.5	54.0	22.0	61.2	24.4
Lime + Manure	95.6	33.1	83.4	31.2	84.2	36.3	83.8	32.4	86.7	33.2
Increase in yield	24%	29%	36%	33%	42%	42%	55%	47%	42%	36%

* Mean six plots for each treatment. Manure applied 8-20 tons per rotation.

Table 3: Comparison of the effect of soil fertility level on yield of corn following corn or soybeans. Webster silt loam—Agronomy Farm, Ames, 4-year rotation

Yield of corn in bushels

	1944			1945		
Soil Treatment*	After Corn	After Soybeans	Difference	After Corn	After Soybeans	Difference
None	51.8	57.2	+5.4	51.1	61.3	+10.2
Lime + Manure	78.2	83.9	+5.7	68.3	79.9	+11.6

* Mean of six plots for each treatment. Manure applied 8-20 tons per rotation.

Table 4: Effect of fertility level on composition of uninoculated and inoculated beans. Clarinda, 1943. Marshall silt loam. Var. Mukden.

Field area*	**	Bean yield bu./acre	Oil Content %	Protein Content %	Oil lb./acre	Protein lb./acre
Terrace A2	O	14.1	19.0	34.0	161	290
	I	17.7	18.5	36.6	196	389
Terrace A1	O	20.1	18.9	36.3	227	438
	I	22.3	18.1	38.6	241	516
Field H	O	22.7	18.7	34.4	255	469
	I	25.6	18.5	37.2	283	571

* These three areas, closely adjacent, had been differently managed. Terrace A2 had been in rotation without a legume, Terrace A1 had a legume included in the rotation, Field H was the hill top.
** O = not nodulated I = nodulated

POSITION IN THE ROTATION

From these experiments and the experience that has been gained it would seem that the decision as to the proper place that the soybean crop should occupy in the rotation should not be too difficult. There is no obviously wrong place. The chief difficulty is that most short rotations carry too high a proportion of soybeans to corn and that the introduction of beans increases the intertilled acreage. The probability is, therefore that where a farm is operated on a regular rotation, soybeans are likely to be maintained as a substitute crop for corn on a portion of the acreage, for example, replacing second year corn in a C C O M rotation. In those level areas where the percentage of intertilled crops is high a C S C O M rotation might be followed on a part of the land.

FERTILIZATION OF SOYBEANS

In acquiring information about proper fertilization of soybeans progress has been disappointing. Perhaps this is because, through urgency, the approach has been the empirical one of trial, not undertaken with any fundamental knowledge of the pattern of plant nutrient requirements of the crop. Of course, it was known by analysis what the total requirements of phosphorus, potash, and calcium, etc., are but this is not enough to provide a guide as to efficient fertilization.

In many experiments in Iowa and other states no responses have been obtained to applications of phosphate or potash in various ways and amounts. Our more recent work makes it probable that in some instances, at least, these have not been the limiting elements. It is our view that the supply of available nitrogen largely determines the yield of the soybean crop, particularly in the higher yield range. Although a legume, and therefore having a supplementary source of nitrogen by fixation in the nodules, the plant can use much more than the nodule bacteria can ordinarily supply. Our best estimates are that on the average prairie soil not more than 20-30 pounds of nitrogen per acre is derived by fixation, and that the remainder, 60-80 pounds or even more, is from the soil. The supply in the soil, and particularly the pattern of its release during the season, may then often determine the yield.

The soybean plant can utilize a generous supply of nitrogen in the midseason period about the time of flowering and additional amounts supplied then in the form of fertilizer may give sigificant yield increases. This has been the case in a considerable number of experiments on a wide range of soils, some of which were reported 2 years ago (*Soybean Digest*, September, 1944). It is as true on soils of higher fertility as on poorer soils. The responses that the soybean crop makes to good soil management practices are probably due to the increased amount of nitrogen that becomes available during this critical midseason period.

These are, therefore, good reasons for believing that in some, at least, of the many fertilizer experiments in which no responses were obtained to P or K, nitrogen may have been the limiting element. This

is supported by the results of eight experiments carried out by K. Lawton on Carrington soils in northeastern Iowa, where responses to potash are good. The average yield increase for PK applications was 3.2 bushels and this was increased to 4.5 bushels by use of nitrogen.

There are some reasons for thinking that the period of maximum demand for P and K, like nitrogen, may be in the midseason period, and that side dressings along the row, which ensure ready availability, may sometimes be a more effective way of meeting the need than broadcast applications either before or after plowing. This season some careful experiments are in progress to determine in detail the nutrient uptake curves throughout the season on soils widely different in fertility.

It is perhaps worthy of comment also that Lawton found that lime can be applied along the row where necessary. In seven experiments in which this was done 20-25 days after planting, an average yield increase of 2 bushels was obtained. Of course, this ordinarily would not be good practice but there are occasions when soybeans are planted on unlimed land because of failure of a previous crop or such adverse weather that no other crop could be planted.

OIL AND PROTEIN CONTENTS

One aspect of this subject that should much interest the processors might be the relationships, if any, between fertility level and composition of beans. The amount of information now available is small and it might be well worth while if additional studies were commenced. If the processors are confronted later with a highly competitive market there might be a case for buying beans on an oil and/or protein content. A somewhat different marketing system might be necessary, and rapid methods of determination of acceptable accuracy would have to be perfected. There are precedents elsewhere; sugar beet has long been bought on the basis of sugar content.

It is well known, of course, that there are varietal differences in the oil content of soybeans and that there is in general an inverse relationship between oil and protein, that is to say, when one goes up the other goes down.

Preliminary results which we have obtained, rather incidentally to other work it must be admitted, suggests that the oil content is slightly but significantly reduced as the general fertility level is increased. This probably occurs because the protein content is somewhat increased by the higher nitrogen status.

In any particular environment uninoculated beans would have the highest oil content. This is not an argument to be used against inoculation, however, because on an acre basis the oil yield of inoculated beans will substantially exceed those of uninoculated beans. It does, however, suggest that if high oil content ever became a desirable goal it might be better that the beans come off lower fertility land.

Our results are not really sufficient yet to establish this with certainty, but the trend is certainly indicative of this. (Table 4) Similarly in experiments in which nitrogen fertilizer has been added either at planting or midseason, where the yield and protein have been increased, the oil content has been reduced.

CONCLUSIONS

In closing it appears that the soybean is not the problem crop that some people supposed. It does not make excessive demands on the land; with proper precautions the erosional hazard is no greater than with other intertilled crops; it responds to good management practices as well as corn; it has no deleterious effects on following crops; it is, perhaps, less of a legume with respect to its nitrogen nutrition than had been thought to be the case, so that the soil nitrogen supply may often determine the yield and affect the response to fertilizer applications of other nutrient elements.

This all implies that on a fertility basis soybeans are interchangeable with or may be substituted for corn and that, therefore, the soybean corn yield relationship may in part decide when it will persist. Its adaptation to soil and climate is not, however, identical with corn, so that in Iowa, at least, acreage reduction when it comes should not be uniform but biassed with this relationship in mind.

THE SOUTHERN REGIONAL

Soybean Variety Program

By PAUL R. HENSON[1]

THE REGIONAL soybean program in the South covers 12 southern states beginning with Oklahoma and Texas on the western end of the region, extending eastward to the coast, including the states of Tennessee and Virginia. The work is being carried on as a cooperative project with the U. S. Regional Soybean Laboratory[2] and the agricultural experiment stations of these 12 southern states. Headquarters for the southern section are located at the Delta Experiment Station, Stoneville, Miss.

1. Agronomist, U. S. Regional Soybean Laboratory, Division of Forage Crops and Diseases, Bureau of Plant Industry, Soils and Agricultural Engineering, Delta Branch Experiment Station, Stoneville, Miss.

2. An organization participated in by the Bureau of Plant Industry, Soils and Agricultural Engineering, Agricultural Research Administration, U. S. Dept. of Agriculture, and the Agricultural Experiment Stations of Alabama, Arkansas, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Louisiana, Michigan, Minnesota, Mississippi, Missouri, Nebraska, North Carolina, North Dakota, Ohio, Oklahoma, South Carolina, South Dakota, Tennessee, Texas, Virginia, and Wisconsin.

The culture of soybeans as an oil crop is not new to the South. In 1920, the four leading states in the production of soybeans for seed were: North Carolina, Virginia, Alabama and Missouri. In 1931, of the Southern states, only North Carolina remained in this top group. Since that time the production in the southern states in percent of the total U. S. crop has steadily declined. The lack of adapted varieties suitable for bean production, the conflict with cotton for labor, the absence of adequate farm machinery on the cotton and tobacco farms, and the adverse climatic conditions over much of the South during the late fall and early winter when soybeans are ready for harvest, are factors which have discouraged the production of soybeans as an oil crop.

The regional soybean program in the South has as its objective: the development of better adapted, higher yielding strains of soybeans for industrial utilization. Varieties must be developed that are high yielding, resistant to shattering, lodging, diseases, and have a content of oil and protein most desirable for industrial utilization.

When Regional Laboratory and university agronomists get together, at ASA convention in St. Louis. From left to right, back row: Robert B. Carr, Stoneville, Miss.; L. F. Williams, Urbana, Ill.; Dr. Howard W. Johnson, Beltsville, Md.; Paul R. Henson, Stoneville; Dr. W. B. Allington, Urbana; Dr. Donald W. Chamberlain, Urbana. Front row: J. L. Cartter, Urbana; C. R. Weber, Ames, Iowa; Dr. D. F. Beard, Ohio State University, Columbus; Dr. W. J. Morse, Beltsville; Dean F. McAlister, Urbana; Dr. Lewis C. Saboe, Columbus; and Carl V. Feaster, Columbia, Mo.

The varied rotations and cropping practices characteristic of different sections of the South necessitate the development of adapted varieties covering a wide range in maturity. Cotton farmers of the Mississippi Delta section of Tennessee, Arkansas, Mississippi and northern Louisiana, desire a variety which will mature in August or early September, in order to utilize their labor supply more efficiently. There is a definite need over much of the South for a variety that will mature in September or early October, in order that winter grains or alfalfa may be planted after the soybeans are harvested. In the Southeast, where it is a common practice to plant soybeans after small grains, and in south Alabama after early potatoes, a somewhat different variety may be needed. The farmers of certain sections of Oklahoma and Texas want a high yielding drought resistant variety that will set and develop seed during the hot dry summer months. These factors are being considered in the development of better varieties for the different sections of the South.

Breeding and selection work to develop better varieties is under way at a number of the southern agricultural experiment stations in the cooperative improvement program. New strains as rapidly as they are developed, are entered in uniform variety tests and are grown across the southern region. The varieties of similar maturity are grouped in uniform tests according to a system established by the U. S. Regional Soybean Laboratory in 1938.

The southern varieties and strains are entered in the progressively later maturing groups of VI, VII, and VIII. Through the middle South, the strains of group VI normally mature from October 1 through 15, those of group VII, October 16-31, and Group VIII, in early November. The maturity of these groups is a few days later across the upper South and earlier in the lower South. Because of the interest in early maturing soybeans, the uniform test, Group IV, is being grown at a number of locations across the upper South. Yields with other agronomic data are taken by the cooperators in the region. Seed samples from the tests are sent to the U. S. Regional Soybean Laboratory for chemical analyses.

LATE SEPTEMBER VARIETIES

It should be pointed out that we do not have any commercial varieties of the maturity of Group V. At Stoneville, the normal maturity of S100, the latest variety of Group IV, is September 8 to 12, while Ogden of Group VI matures October 4 to 8. The breeding of new varieties which will mature during this period is particularly desirable; first, because farmers would have more time for planting winter grains after the soybean harvest than after Ogden, and second, climatic conditions during this 26 to 30 day period are usually well suited for harvesting soybeans.

In this connection an entirely new group of strains developed in the southern breeding program, of Group V maturity, will be entered in the uniform tests in 1947. These strains have been developed through the selections out of crosses between northern and southern varieties of soybeans. We feel very hopeful that high yielding strains of this maturity will be developed.

Testing soybean varieties on a regional basis began in 1943. A large number of varieties and strains of soybeans have been tested over the 3 year period. Each year in planning the tests, varieties showing little promise, or ones that have been adequately tested are dropped and new ones, developed by plant breeders in the Southern states, are added. In planning the 1946 tests, 19 older varieties and strains were dropped from the tests and 12 new strains were added. We expect that a still greater number of new strains will be available for testing in 1947.

Two new early strains of Group IV maturity, S100 and C101, have yielded well across the upper South. S100, a rogue out of Illini, was developed under the direction of Mr. B. M. King, agronomist of the Missouri Agricultural Experiment Station. The seed are yellow, medium in size and low in percent oil, 19.7 as compared to 21.3 for C101 in 1944-45 tests. The variety is tall-growing with gray pubescence and white flowers. S100 is high-yielding and is well adapted across the upper South. Excellent yields of good seed have been secured as far south as Stoneville, Miss. Seed of this variety is being increased, and it is expected that some seed will be available to farmers in 1947.

C101 is a selection out of the cross Dunfield x Manchu by the Purdue Agricultural Experiment Station. This strain is a week earlier than S100, and has not yielded as well as S100 in the eastern half of the southern region. Although C101 is a high oil strain, it is much shorter and could not be combined as readily as S100. The agronomic and chemical data pertaining to these varieties are shown on table 1.

Of the varieties of Group VI maturity, Ogden is definitely the most productive soybean for the South. It was developed from a selection from the cross, Tokyo x P. I. 54610, by the late H. P. Ogden, agronomist of the Tennessee Agricultural Experiment Station. The variety is an erect, bushy type of medium height with gray pubescence and purple flowers. The seed are green, or olive yellow, medium in size and high in percent oil. Ogden is more resistant to leaf diseases than any of the other varieties of this maturity. A serious objection to Ogden is that it will shatter shortly after maturity if very dry climatic conditions prevail at that time. Shattering appears to be more severe on light-textured infertile soils.

Ogden has been entered in the uniform variety tests all 3 years, 1943-45. A summary of the agronomic and chemical data of Ogden in comparison with Arksoy 2913, Mamredo, and Ralsoy is given in table 2. The decidedly higher yields and the higher oil content of the Ogden variety should be noted from the table. Ogden is well adapted to the central and upper part of the southern region, and led all varieties of Group VI maturity in yield in 19

Table 1: Summary of agronomic and chemical data of the S100 and C101 varieties as compared to standard varieties of similar (Group IV) maturity for the two years, 1944-45.

Two-year Average, 1944-45	S100	C101	Gibson	Patoka	Macoupin	Boone
Yield (Bu. per Acre)[1]	22.7	22.0	19.8	19.4	19.0	18.4
Lodging[2]	2.0	2.0	2.0	1.3	1.9	2.0
Maturity Date	9-21	9-14	9-12	9-10	9-9	9-8
Plant Height (Inches)	36	29	29	25	34	33
Seed Quality[3]	2.8	3.0	2.7	3.0	2.6	3.2
Seeds per Pound	3370	3107	3520	2990	3330	3460
Percent Protein	42.0	40.0	39.8	42.5	39.7	41.1
Percent Oil	19.7	21.3	21.5	21.3	22.2	21.5
Iodine No. of Oil	128.6	128.1	128.3	128.4	126.2	124.1

1—Two-year average yields from the following locations: Baton Rouge and Opelousas, Louisiana; Stoneville and Tunica, Mississippi; Coweta, Fairland, Miami and Stillwater, Oklahoma; Columbia, Crossville, Knoxville and Jackson, Tennessee; Lubbock, Texas; Orange and Blacksburg, Virginia.

2—Lodging notes recorded on a scale of 1 to 5 as: (1) Nearly all plants erect; (2) plants leaning slightly; (3) plants leaning moderately or 25 to 50 percent down; (4) plants leaning considerably or 50 to 80 percent down; (5) 80 percent or more of plants down.

3—Seed quality recorded on a scale of 1 to 5 as: (1) Very good; (2) good, (3) fair; (4) poor; (5) very poor; based on development on seed wrinkling, damage and color for the variety.

Table 2: Summary of agronomic and chemical data of Ogden as compared to standard varieties of similar (Group VI) maturity for the two years, 1944-45.

Two-Year Average, 1944-45	Ogden	Arksoy 2913	Mamredo	Ralsoy
Yield (Bu. per Acre)[1]	27.1	20.3	19.1	18.8
Lodging[2]	1.3	1.8	2.2	1.7
Average Date Matured	10-11	10-10	10-13	10-10
Height Inches)	29	25	32	'28
Seed Quality[3]	2.2	2.0	2.4	2.0
Seeds per Pound	2980	3500	3250	
Percent Protein	40.6	42.9	40.9	42.5
Percent Oil	21.3	20.3	20.0	20.5
Iodine No. of Oil	132.7	132.0	127.6	131.5

1—Two-year average yields from the following locations: Fairhope and Auburn, Alabama; Clarkedale, Hope, Marianna, Stuttgart and Winchester, Arkansas; Watkinsville, Georgia; Baton Rouge and Opelousas, Louisiana; Holly Bluff, Stoneville and Tunica, Mississippi; McCullers and Plymouth, North Carolina; Coweta, Heavener and Stillwater, Oklahoma; Monetta, South Carolina; Columbia, Crossville, Jackson and Knoxville, Tennessee; and Lubbock, Texas.

2—and 3—See footnotes 2 and 3, of table 1.

Table 3: Summary of agronomic and chemical data of Volstate, Roanoke, and CNS, as compared to Wood's Yellow and Palmetto for the two years, 1944-45.

Two-year Average, 1944-45	Roanoke	Volstate	Woods Yellow	CNS	Palmetto
Yield (Middle and Upper South)[1]	26.9	25.9	20.8	17.5	16.3
Yield (Lower South and Southeast)[2]	15.4	15.7	15.0	19.3	17.0
Lodging[3]	1.8	1.8	1.6	3.0	2.9
Average date matured	10-28	10-26	10-30	10-29	10-26
Height (Inches)	34	33	34	32	50
Seed Quality (4)	1.9	1.8	2.4	2.0	2.1
Seeds per Pound	3000	2990	2070	3500	3750
Percent Protein	39.9	39.9	42.6	45.0	44.8
Percent Oil	21.9	21.5	19.4	18.5	18.0
Iodine No. of Oil	132.4	133.1	128.9	129.5	129.9

1—Two-year average yield from the following locations: Clarkedale, Marianna, Hope, Fayetteville, Stuttgart and Winchester, Arkansas; Experiment and Watkinsville, Georgia; Stoneville, Holly Bluff, State College and Satartia, Mississippi; McCullers, Plymouth and Willard, North Carolina; Florence and Monetta, South Carolina.

2—Two-year average yield from the following locations: Auburn and Fairhope, Alabama; Tifton and Richmond Hill, Georgia; Blackville, South Carolina; and Baton Rouge, Louisiana.

3—and 4—See footnotes 2 and 3, table 1.

Table 4: Summary of agronomic and chemical data of the three Louisiana varieties as compared to standard varieties of similar (Group VIII) maturity for the two years, 1944-45.

Two-Year Average, 1944-45	Acadian	Pelican	L. Z.	Mamloxi	Nanda	Mamotan	Woods Yellow
Yield (Lower South and Southeast)[1]	21.8	20.2	19.8	15.8	15.8	14.5	11.0
Yield (Middle South)[2]	21.9	21.6	20.8	21.2	22.5	22.2	22.1
Lodging[3]	2.6	3.2	2.8	1.8	1.8	1.6	1.4
Average date matured	11-2	11-3	11-3	11-6	10-30	11-1	10-29
Height (Inches)	54	54	54	42	37	38	35
Seed Quality (4)	1.6	1.6	1.7	2.5	2.0	2.1	2.3
Seeds per Pound	3520	3950	3890	3050	2580	2580	2100
Percent Protein	43.3	42.3	43.3	43.4	41.9	42.6	43.1
Percent Oil	20.0	20.4	19.6	18.2	20.3	19.3	19.3
Iodine No. of Oil	134.2	135.3	135.2	136.4	129.1	135.3	128.2

1—Two-year average yields from the following locations: Tifton and Richmond Hill, Georgia; Baton Rouge, Louisiana; and Auburn, Alabama.

2—Two-year average yields from the following locations: Raymond and Stoneville, Mississippi; McCullers, North Carolina; Marianna, Stuttgart and Hope, Arkansas; Experiment, Georgia; and Monetta, S. Carolina.

3—and 4—See footnotes 2 and 3, table 1.

out of 23 tests where 2 year average yields are available.

This is an outstanding record when the wide variation in soil and climatic conditions across the Southern Region is considered. The soybean breeders in the South have made many crosses with Ogden and other varieties to develop non-shattering varieties having the yielding ability of this variety. A number of non-shattering hybrid lines from these crosses are being tested this year.

Arksoy 2913 and Ralsoy have yielded well in northen Arkansas and in Tennessee. Under dry climatic conditions these two varieties shatter much less than Ogden. These strains, however, produce satisfactory yields only in this limited area, Ogden being far superior in other areas.

Two varieties of Group VII maturity, Volstate and Roanoke are superior to the old established varieties of similar maturity. The comparative results of these varieties with Woods Yellow, Palmetto and CNS for the 2 years 1944-45 are given in table 3 above.

The Volstate variety is of Tennessee origin, having been selected out of the same cross as Ogden by the late H. P. Ogden, of the Tennessee Agricultural Experiment Station. Volstate is a medium-tall variety with gray pubescence and white flowers. It has been tested all 3 years in the uniform tests, Group VII. It matures 10 days to 2 weeks later than Ogden, shatters less, and produces high yields of excellent quality yellow seed.

The Roanoke variety was selected from a mixed seed lot in the fall of 1941. The strain was developed under the direction of Mr. J. A. Rigney, associate agronomist of the North Carolina Experiment Station, and Dr. E. E. Hartwig, associate agronomist, U. S. Regional Soybean Laboratory, Bureau of Plant Industry, Soils and Agricultural Engineering, USDA. The variety was entered in the regional variety test, Group VII in 1944. The excellent showing of Roanoke the first year in the regional tests and in other tests in North Carolina left little doubt as to the superiority of this variety.

The Roanoke variety is very similar to Volstate in appearance. It is higher in oil and has yielded slightly more than Volstate in the majority of the tests. Both varieties are superior to Woods Yellow in yield, resistance to shattering and content of oil. These varieties are adapted to the central South, an area which includes the upper third of Louisiana, the lower half of Arkansas and extends eastward through the mid-South to include the Piedmont and Coastal Plain area of North Carolina. Neither of these varieties yield well in the lower South or Southeast.

A third variety of Group VII maturity which has looked promising in the Southeast is CNS. This variety was selected out of the Clemson variety by Mr. J. E. Wannamaker, of St. Matthews, S. C. The plants are of medium height with tawny pubescence and purple flowers. CNS lodges more than either Volstate or Roanoke and is much lower in percent of oil. One particularly desirable characteristic of CNS is the fact that it is resistant to Bacterial Pustule, a serious leaf disease of soybeans over much of the region. The plant breeders lost little time after this fact became known in making crosses with CNS and other varieties to get resistance to this disease in more widly adapted varieties. Plants resistant to Bacterial Pustule have been selected out of progenies of these crosses.

CNS is well adapted to the Coastal Plain soils of South Carolina, Georgia and Alabama.

The varieties and strains of Group VIII, the latest maturing group in uniform tests, are adapted to the lower South and Southeast. The three new varieties, Acadian, Pelican and L. Z. appear very promising for the lower South. These strains were selected from crosses by Mr. John P. Gray, associate agronomist of the Louisiana Agricultural Experiment Station. All three varieties are tall-growing and similar in appearance.

The Louisiana varieties lodge very little on the lower Coastal Plain soils, hold their seed much better than the strictly grain types and equally good for grain or hay. In dates of planting tests at Baton Rouge, La., and Tifton, Ga., the Acadian variety, in contrast to other varieties tested, produced good seed yields over a long planting period. The oil content of these varieties is higher than Woods Yellow, Mamloxi, Palmetto, and other varieties grown in this region.

In addition to the immediate value of the results of uniform variety tests, the information gained as to the good and poor qualities of the varieties is being utilized in the southern breeding program. Large numbers of hybrid lines and new strains are under observation, or are being tested at many southern experiment stations.

Crosses have been made between a number of northern and southern varieties by Dr. L. F. Williams of the U. S. Regional Soybean Laboratory, and by Mr. J. A. Rigney and Dr. E. E. Hartwig in the cooperative breeding program at the North Carolina Agricultural Station. Promising early strains having a high oil content are being selected out of crosses with high-yielding, high-oil northern varieties. These include Lincoln, Dunfield and Chief, and such southern varieties as Arksoy, Ogden, Herman and Volstate.

Several non-shattering hybrid lines which appear to have the yielding ability of Ogden are under test. Crosses between Palmetto, Missoy and CNS and high yielding grain types, S100, Ogden, Volstate and Roanoke are expected to produce high-yielding strains better adapted to the Southeast.

In conclusion a number of new soybean varieties have been developed which definitely enhance the position of soybeans as an oil crop for industrial utilization in the Southern states. The new varieties, varying in maturity from early September for S100, to early November for the Louisiana varieties, are of wide adaptation. The southern farmers have a much better opportunity of selecting a high yielding variety better suited to the particular cropping practices in use on his own farm.

THE WORLD SITUATION....

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WORLD TRENDS IN MAJOR OIL CROPS

and Their Effect on Soybean Acreage in the United States

By PETER L. HANSEN

BEFORE the second World War began it was generally felt that the rapid increases in the world supply of fats and oils would soon result in an over supply with a further decrease in prices. This view was primarily based on the rapid expansion in the production of tropical oils during the period between the two World Wars. It was also supported by the greatly increased production of whale oil and of several other fats and oils.

The outbreak of war in the Pacific brought a quick change in the fats and oils situation. Critical shortages developed rapidly as Japan occupied large parts of the vegetable-oil producing areas in the Far East. Whaling ceased almost completely. In an effort to meet the shortages, the production of vegetable oil crops was greatly expanded in many countries during the war years. In the United States, for example, the combined acreage of soybeans, flaxseed, and peanuts more than doubled. In Argentina, the production of sunflower seed reached a level more than four times that of prewar years. In Africa, special efforts were made in Belgian Congo and elsewhere to expand the production of palm oil and palm-kernel oil. In Europe the production of oilseed crops was greatly increased in several of the countries under Nazi domination, although not enough to offset the decline in production of animal fats.

REORGANIZING PROGRAMS

The major vegetable oil producing areas of the world are now in the process of reorganizing their production programs and within a few years many of these areas may be expected to recover much of their prewar markets. Whaling is being resumed, although as it is under stricter international control it may not again reach former levels of output. Current political unrest in China, Manchuria, and the Netherlands East Indies may retard recovery. In the case of Manchuria there may be a permanent shift away from world outlets to markets inside Asia.

As the tropical areas appear to hold a natural advantage in the production of vegetable oils this is likely to mean that many of the countries which expanded the production of vegetable oils during the war will be faced with a problem of reconversion. In most countries this conversion is a matter of changing from one or more commodities, temporarily made profitable by war created conditions to products which are more profitable in the long run under peacetime conditions. However, it seems clear at this time that the acreage of soybeans in this country will continue at a level well above prewar even though somewhat below wartime levels. This will be the result of a stronger competitive position due to improved practices in growing soybeans, use of higher yielding varieties, and a wider use of soybeans and soybean oil meal for food, feed and for other purposes.

The present outlook for world cooperation through the United Nations suggests a high level of world prosperity with a rising level of living and a high rate of employment in the industrialized countries.[1] Under such conditions it must be expected that the strong upward trend in production of the major vegetable oil crops which existed before the second World War will be continued. The plantation system of production of the tropical vegetable oil crops, palm oil, palm kernels, and coconuts may be further developed. Tropical production will also be given additional impetus by improved methods of transportation, new ways of utilization, and lower cost methods of refining and processing. Moreover, the growing population of the world and an expected rise in the volume of international trade may make it necessary to provide additional production of oils to supplement available supplies and to substitute for the relatively low supplies of animal fats.

The total world production of oils and fats before World War II averaged about 20 million metric tons annually in terms of oil equivalent. Of this quantity approximately two-thirds consisted of vegetable oils while the remainder was made up of animal fats and marine oils. These figures do not include the so-called invisible consumption in foods nor the direct native consumption of coconuts and other tropical nuts. During the past 25 years, vegetable oils have come to constitute a larger and larger share of the total visible supplies of fats and oils. This is primarily a result of increased consumption of animal fats in invisible form in such items as ice cream and fluid milk.

1. What Peace Can Mean to American Farmers, Expansion of Foreign Trade, Misc. Pub. No. 582, 21p., U. S. Dept. of Agric., Washington, D. C.

• *The Author, an economist of the Bureau of Agricultural Economics, believes that while oil prices may fall to lower levels, the demand for soybean oil meal may support the production of soybeans in the U. S.*

The average annual production and net export of 15 of the world's major vegetable oil crops, which account for approximately 90 percent of the world's vegetable oils in terms of oil equivalent have been computed for selected 5-year periods (table 1). According to these figures, the world production averaged almost 2 million metric tons a year, or 17 percent higher during the 5-year period 1934-38 than during 1924-28. During the same period net export increased 800,000 metric tons or about 23 percent.

Table 1—Average production and net export of 15 major vegetable oil crops from leading producing countries for selected periods.

Period	Production 1,000 metric tons[1]	Net export 1,000 metric tons
1909-13	8,465	2,272
1924-28	11,349	3,403
1929-33	12,625	3,827
1934-38	13,268	4,196

1. One metric ton equals 2204.6 pounds.

The vegetable oil crops which have shown the greatest increase over the 30 years preceding the war are the tropical oils, palm and coconut, and the temperate zone oils, peanuts and cottonseed. Rapeseed, sesame seed, and sunflower seed are other important oil crops. These crops have a large annual production, but only small quantities enter the world market. In addition to linseed oil, tung oil and perilla oil are important in international trade because of their use in paints and varnishes. Some newer oil crops—such as babassu kernels and castor beans—have become of increasing importance in recent years.

During prewar years most of the international competition in vegetable oils was furnished by two tropical regions. One of these regions is Southeast Asia. This includes the Philippine Islands, the Netherlands East Indies, and Malaya. The other region is in West Africa. This consists of French, British, and Belgian colonies. The net exports from these areas, shown in the accompanying illustration, supplied over 80 percent of the average increase in world export between the 5-year periods 1924-28 and 1934-38. The trends in production and net export suggest that these tropical regions have a definite comparative advantage over the temperate zones in the production of vegetable oils. It is

likely, therefore, that the principal part of any increase in the production and net export of vegetable oil during the next 10 years will occur in these areas. Moreover Southeast Asia and West and Central Africa appear to have limited opportunities so far as other development is concerned.

Comparative yields of vegetable oils in terms of oil equivalent for selected areas and crops in the tropical and the temperate zones vary widely (table 2). In terms of oil, the highest producing vegetable oil crop is palm. This oil in the Netherlands Indies, in 1936 averaged some 2,300 pounds per acre not including about 200 pounds of oil in the palm kernels. The average yield from coconuts of 730 pounds per acre is less startling but is still very high. The yield of soybeans in Illinois in 1944 in terms of oil averaged about 210 pounds of oil per acre, while peanuts in North Carolina average about 357 pounds per acre in 1942. These were years with relatively high average yields. It must be remembered of course, that the peanuts grown in North Carolina as well as many coconuts are used for direct consumption. Moreover, the total value of the soybean crop is not determined alone by the oil obtained but is determined to an equal or higher degree by the value of the oil meal. This is also the case, although to a lesser extent, for peanuts and coconuts.

The production of vegetable oils in the tropics seems capable of much further expansion, particularly in certain parts of Brazil, Africa, and the Netherlands East Indies. This is true not only for the acreage under the plantation system of production but also with respect to the small-scale native producers whose practices could be vastly improved. Better management and the use of new varieties would greatly increase the yield of coconuts from native groves which apparently average only about half that obtained on the plantations.

A forward estimate of world production and net export has been made for a year, about 1955, in a recent study by the Bureau of Agricultural Economics.[2] Such estimates are of course subject to several assumptions and uncertainties and are not forecasts in any sense. In this case they are based on relatively favorable assumptions regarding world prosperity and employment as well as greater freedom of international trade than existed before the war. The estimated increase in the world production of the 15 major oil crops in 1955 over 1934-38—a period of about 19 years—is nearly 2,500 thousand metric tons, or about 16 percent. The estimated increase in net export for the same period is 900 thousand metric tons or about 21 percent. The absolute increases are only slightly greater than those actually made between the two 5-year periods 1924-28 and 1934-38 mentioned earlier.

Table 2—Average yield per acre of vegetable oil from selected oil crops for specified areas.

Crop	Year	Country or area	Total area in production	Yield per acre in terms of oil
			Acres	Pounds
Palm	1936	Netherlands East Indies	167,744	[1] 2,503
Coconuts	1932	Philippine Islands	924,000	[2] 730
Soybeans	1944	Illinois	3,470,000	210
Peanuts	1942	North Carolina	270,000	357

1. Includes about 200 pounds of palm kernel oil.
2. Individual plantation yields of as much as 1200-1400 pounds of oil per acre are not unusual.

What does an expanded world production of vegetable oils mean to the United States? If the conversion from war to peace is reasonably prompt around the world and if peaceful relations and a reasonable movement of trade among nations continue, it is quite possible that a very large output of vegetable oils will be needed and consumed even during the period when the buying power in Europe will be low as compared with prewar levels. The world's population is still growing and all signs point to rapid economic progress in some of the less developed areas of the world, if the opportunity materializes. A rising level of living in China, India, and the Soviet Union could bring the consumption of vegetable oils in these countries far above prewar levels. Accordingly, an increase of 21 percent or a little over 1 percent annually in net world export of vegetable oils over the 1934-38 level by 1955 may be well within the world's consuming capacity. This is particularly true since only 600 million pounds of whale oil may be produced annually as compared with about 1 billion pounds before the war.

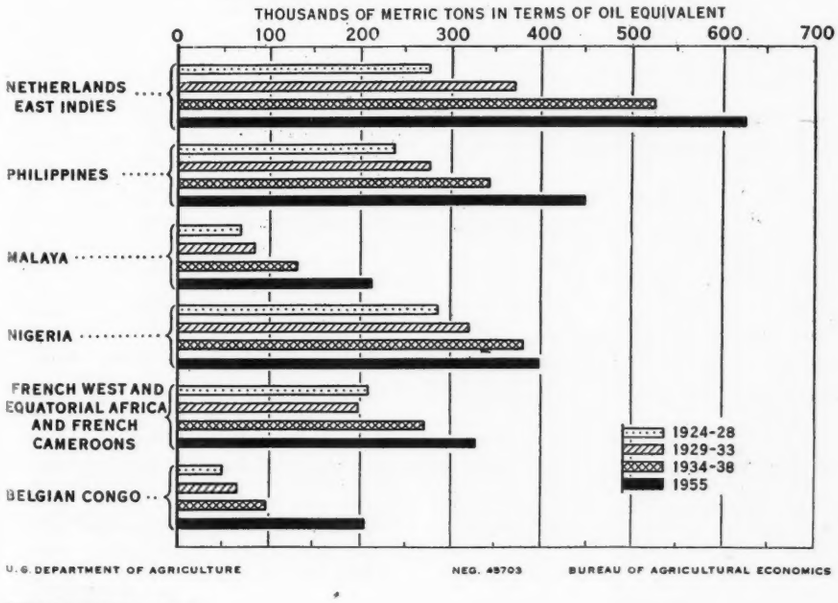
From steps already taken toward aiding the expansion of international trade—resulting from such important international conferences as those held at Hot Springs, Bretton Woods, Dunbarton Oaks, and San Francisco—as well as by the extension of the Reciprocal Trade Agreement Act, it appears reasonable to assume that there will be fewer restrictions on foreign trade than existed when the war began. Any increase in the freedom of trade would contribute toward an increase in the level of living as it would make for greater exchange of those commodities for which each country possesses a comparative advantage in production. Coconut oil imported from the Philippines to the United States might be offset by the export of larger quantities of lard and perhaps soybeans.

The United States imported approximately 20 percent of its consumption of fats and oils before the recent war. A large part of these imports consisted of fats and oils used for industrial purposes and for which adequate substitutes in sufficient volume were not produced in this country. A return toward this position may take place during the next decade. The domestic production of cottonseed oil, soybean oil, and lard is likely to continue to be adequate to supply our need for these oils for food with some left for industrial use and export. Industrial oils that have been imported for a long time include those used in the drying industries such as linseed, tung, and perilla oil and those used in soap, tin plate, and other manufacturing, such as coconut, palm, and palm kernel.

The average world prices of the vegetable oils may fall to somewhat lower levels as the relative proportion of tropical oils entering world trade continues to rise during the coming years. Moreover, a high level of world employment and prosperity would result in a relatively greater demand for pork and dairy products particularly in countries with temperate climate like the United States and Northern Europe. These are lines of production in which the farmers in these countries excel. Hence, the output of these products may expand relatively more than other farm enterprises, including the oil crops. The high value of soybean oil meal may tend under these conditions to support the production of soybeans in this country.

2. **World Trends in Major Oil Crops,** by Peter L. Hansen, 62 pp. processed. Bur. of Agric. Economics. Washington, D. C. March 1946.

AVERAGE NET EXPORT OF THE MAJOR OIL CROPS FROM SIX LEADING AREAS FOR SELECTED PERIODS AND AN ESTIMATE FOR A YEAR ABOUT 1955



Soybeans and the

WORLD FATS AND OILS SITUATION

By FRED J. ROSSITER
USDA's Office of Foreign Agricultural Relations

SINCE about three-fourths of the total soybean production in this country is crushed for oil, there is interest in the future outlook for this oil and the competition it is likely to encounter from fats, oils, and oilseeds produced in other parts of the world. Soybean oil is considered one of the most versatile of our vegetable oils. It was used in many industries before we had wartime government restrictions and quotas on its consumption. In 1941, about 80 percent was used in edible products, 10 percent in the paint and drying industry, and 10 percent in other industrial uses.

Since this oil can be readily utilized for various purposes, it has many competitors. Therefore, it is necessary to examine world production and trade of the whole field of fats and oils in order to appraise and analyze the future of our domestic soybean industry. It is important to know not only about the Manchurian soybean situation, but also about Philippine coconut oil, Netherlands Indies palm oil, African peanut production, as well as the Argentine flaxseed situation. It is recognized that, since fats and oils are interchangeable in one way or another, a worldwide shortage or surplus of one affects the price and consumption of all others.

THE CHANGE SINCE 1939

The present world fats and oils situation is materially different from that of 1939. The results of wartime blockades, enemy occupation of producing areas, and inadequate shipping have seriously curtailed production and trade in many countries. It will be of interest to point out some of the principal changes that have occurred and to examine the competition that the American soybean industry is likely to meet in the postwar period.

The estimated total world production of 21 major fats and oils in 1935-39 averaged about 21.5 million short tons in terms of oil. (In arriving at this estimate, a quantity for seed and feed for each commodity was deducted, as well as the peanuts and soybeans that were used directly for human food.) Included in this total are all of the important vegetable oils, such as soybean, cottonseed, peanut, sunflower seed, coconut, palm, flaxseed, as well as the animal fats—lard, tallow, butter—and the marine oils—whale and fish. In 1946, total world production of these same fats and oils is estimated at about 17.5 million tons, or 20 percent below the prewar level.

The greatest reduction during the war was in the palm oils; namely, coconut oil and palm oil. Marine oils also declined sharply. World butter production has been reduced substantially. On the other hand, two phenomenal developments in vegetable oilseed production occurred during the war —namely, sunflower seed in Argentina and soybeans in the United States. Argentina's sunflower seed production in 1936 totaled 81,000 tons, whereas in 1946 it reached 1,100,000 tons. Some of you will recall that soybean production in the United States in 1936 totaled only 33 million bushels. If anyone had predicted 10 years ago that this country would soon be producing nearly 200 million bushels, most of you would have thought that he was a little off.

In view of the world shortage of fats and oils created by the war, it is recognized that the increased soybean production in this country was of tremendous aid to the United Nations in meeting one of the critical problems of the war. Our scientists, farmers, and industrial leaders merit the gratitude of our nation for this achievement.

To illustrate the importance of our increased production, it should be pointed out that this country during 1935-39 was a net importer of nearly 1 million short tons per year of fats and oils. As a result of our wartime expansion in production of soybeans, lard, and flaxseed, and in spite of increased domestic consumption, this country has been a net exporter of fats and oils during the past 4 years. These exports were greater than normal because our government considered it necessary to restrict our domestic consumption in order to assist other countries in obtaining their minimum needs of fats and oils during these critical years.

While total world production of all fats and oils is now 20 percent less than before the war, the volume of fats and oils available for international trade has shrunk to an even greater extent. The total net world trade of fats and oils during 1935-39 averaged about 6.5 million tons. (This figure represents shipment of fats, oils, and oilseeds only from original sources of production and does not include reshipment of oil from one country to another). From 1942 to 1945 the volume of international trade in fats and oils fell to about 2.5 million tons annually. The principal reason for this tremendous decline was the Japanese occupation of the Far Eastern areas, which normally contributed about 2¼ million tons of oil.

SHORTAGE IS STILL CRITICAL

In 1946, we are still faced with a most critical world shortage of fats and oils. Liberated Europe is seeking its prewar imports, but many prewar sources of supply are not yet available. Several European countries are at the present time consuming fats and oils at less than 50 percent of their prewar rate. Even the United States would consume an additional million tons of fats and oils this year if it were available. Total world import requirements for 1946 equal 5 to 6 million short tons. To meet this demand, supplies available for export from all sources this year are estimated at less than 3 million tons.

It is apparent that world production is now expanding and that supplies available for international trade next year may be substantially above the 1946 volume. No one knows how long it will take for total world production to come up to world requirements.

No doubt many of you are anxious to know whether our soybean industry in the future must shrink because of increased competition from foreign oils, or whether we might hold our own or possibly even increase our production if we could ship beans and/or oil abroad. In order to appraise foreign competition, let us examine briefly the production and trade of some of the major fats and oils.

MANCHURIAN PRODUCTION

First, let us look at soybean production in other countries. In Manchuria, production during 1930-39 averaged about 160 million bushels, and exports of beans and oil during the same period averaged 96 million bushels in terms of beans, or a total of 433,300 short tons in terms of oil. Manchurian production and exports declined materially during the war. The latest official figures were for 1943, which placed the crop at 113 million bushels. The 1945 harvest was reported to have been slightly over 100 million bushels. Information received indicates that soybeans have been exported to the Soviet Union this year, but the quantity is believed to be small. Crop prospects for this year are reported favorable, but it is doubtful if production can be increased much above that of last year. Because of the political unrest in that area, Manchurian production and exports seem unlikely to reach the prewar level for some years.

While soybean production in China proper has been placed at about 200 million bushels annually, the total crop is generally required for domestic use, and little, if any, beans or oil have been available for export. If world prices advance to a high level, it is possible that China and Manchuria might begin to export substantial quantities within a year or two.

Soybean production in Korea and Japan before 1942 averaged from 10 to 20 million bushels in each country. During the war, Japanese production declined, and imports from Manchuria increased. This past winter, General MacArthur requested soybeans for importation into Japan. None could be obtained from Manchuria, and only insignificant quantities were shipped from this country. Japan, in the postwar years, may be a market for a small quan-

• *The author believes that although world production of fats and oils will expand there should be a market at fair prices for some years for U. S. soybeans and soy oil.*

tity of soybeans, but it is doubtful whether the volume will ever be significant.

European soybean production prior to the war was small but was increasing. It was confined largely to Rumania, Bulgaria, and Yugoslavia, where German commercial companies sponsored the crop by financing farmers and purchasing the soybean harvest. In 1945, with the exit of the German army from these countries, soybean production immediately almost disappeared.

Many countries in other parts of the world have been growing soybeans, but at this time nowhere does it appear that cultivation will be extensive in the near future.

COTTONSEED OIL PRODUCTION

World cottonseed oil production in 1935-39 averaged about 1.7 million tons, but by 1945 it had declined by 35 percent. Cotton oil affords little or no competition with the other vegetable oils in continental Europe. Prior to the war, Egypt shipped some cottonseed and oil to the United Kingdom, but little cotton oil was available in other European countries. Although cottonseed oil is one of the world's chief sources of vegetable oil, it is largely consumed within the country in which it is produced, and relatively insignificant quantities move into international trade.

Peanuts are grown extensively in India, China, West Africa, and the United States, but only in this country is the major portion of the crop consumed as nuts. Among the annual oilseed crops, the international trade of peanuts and peanut oil is by far the largest. Prior to World War II, peanuts were the most important oilseed crushed by the European oil mills, and the consumption of peanut oil in western Europe exceeded that of all other edible oils.

Sunflower seed oil until 1940 was produced and consumed in volume only in the Soviet Union. When olive oil became difficult to obtain from the Mediterranean countries, Argentina began to emphasize the production of sunflower seed, which had been a minor crop until 1940. Production skyrocketed during the war, with the 1946 crop yielding from 200 to 250 thousand short tons of oil. Argentina is now consuming about half its production. In this postwar period, it appears that Argentina sunflower seed oil is going to be a factor in the international vegetable oil trade. At what price we do not know, but this is one competitor that deserves future attention.

Let us now consider another oil that has been of interest in this country for some time, namely, coconut oil. World production during 1935-39 was estimated at 1,600,000 tons, whereas production in 1945 was placed at 700,000 tons. The two great producers of copra, the source of coconut oil, are the Netherlands Indies and the Philippine Islands. Ceylon is the third most important area and was the principal source of our supply during the war, The Netherlands Indies, prior to the war, was the leading producer, but because of large domestic consumption, it ranked **second as an exporter.** Production of copra practically ceased in the Netherlands Indies and the Philippines during the Japanese occupation. The groves were neglected, but only a small percentage of the trees were destroyed.

The reestablishment of the Philippine copra industry is moving along at a good rate, and within a few months the output may be near the prewar level. Copra exports are now averaging 50,000 tons per month, and about 65 percent of this volume is allocated to the United States.

The rehabilitation of the Netherlands Indies copra industry has got off to a slow start. The coconut trees, from which copra for export is produced, are mostly in areas governed by the Dutch, and the natives are anxious to get production under way. Interisland boats and incentive goods are needed in greater volume, however, before any sizable output can be achieved. Our government has recently agreed to assist the Netherlands Indies government in getting this industry started. Present indications are that the 1947 output from that area may reach or exceed 50 percent of the prewar exports. Copra exports from those islands are allocated primarily to Europe.

Total world exports of copra and coconut oil during 1935-39 averaged about 1,300,000 tons in terms of oil. Exports this year are expected to be only about 35 percent of the prewar level, but copra production may regain prewar volume within the next 2 years. Production above this level is not probable for some time, since no new groves have been set out in recent years. With high prices, however, new plantations will be started, and eventually production may surpass previous records.

Palm oil is another foreign oil that has often been cussed and discussed in this country. Palm oil originates almost exclusively in West Africa and the Netherlands Indies. West African production has been gradually expanding over the past four decades. The development in the Netherlands Indies was begun after World War I and was rapidly expanded. Exports had almost reached the volume of West African exports when World War II came along and virtually knocked out production. The palm oil industry of the Netherlands Indies is centered primarily in Sumatra. Those areas are, at present, under the independent Indonesian government. Reports indicate that the palm oil mills were largely destroyed and island communications disrupted during the war. Practically no palm oil has come out of that area since "V-J Day," and, with the political unrest, it is hazardous to predict when exports can be restored in volume.

The Netherlands Indies in 1940 exported about 200,000 tons of palm oil. According to present indications, it will be some time before the prewar level is again reached and several years before new plantations come into production. West African palm oil exports are now near the prewar level, but little increase is expected from that area, with the possible exception of the Belgian Congo, where plantations were established in the 1930's.

Let us look briefly at the industrial oils. In the United States, the greatest shortage in any one group at the present time is, undoubtedly, in drying oils, and a considerable quantity of soybean oil will be used in the paint industry when it can be released from food uses. World production of drying oils has declined only slightly below that of prewar years. The inability to obtain Argentine flaxseed and/

New Storage for Decatur Soy Products Co.

Workmen pour concrete for 200,000 bushel capacity storage space being erected by Decatur Soy Products Co., Decatur, Ill. It is expected that these bins will be ready for 1946 crop soybeans.

or linseed oil, the availability of only small quantities of Chinese tung oil, and the absence of Manchurian perilla oil have reduced supplies this year. Considerable increase in the use of dehydrated castor oil has been made by the drying industry during the war, but even this oil is hard to obtain at the present time. Reduction in availability of supplies, added to the tremendous demand for drying oils in the United States and Europe, has accentuated the present world shortage. The world supply of linseed oil may be increased, however, within a year or two, with good flaxseed prices and favorable crop weather, especially in Argentina.

The world production and supply of animal fats—butter, lard, and tallow—have an influence upon the demand for soybean oil.

BUTTER DECLINES

In 1946, world production of butter has declined about one-fourth below that of the prewar level. European production has decreased as a result of reduced cattle numbers, and in the United States production has fallen on account of increased fluid-milk consumption. With a shortage of butter, there is an increased demand for margarine and other products. The replacement demand in most countries cannot be measured at this time on account of the shortage of substitute fats and oils.

World production of lard is now about 20 percent below the prewar level, because of the large reduction in European hog numbers. Production in the United States this year is substantially below the 1944 record, but it is still above the 1935-39 average. United States production normally represents about one-third of the world total, and this country contributes about 75 percent of the lard which enters international trade. You will recall the emphasis on the production of bacon-type hogs during the 1930's, when the world supply of fats and oils was abundant and prices were low. With current world shortage, undoubtedly, our lard-type hogs will have another inning.

World tallow production in 1946 is slightly above the 1935-39 level. Although European production has been reduced, increased cattle slaughter in the United States and South America has more than offset this loss. International trade in tallow is relatively small. The chief exporting countries are Argentina, Australia, and New Zealand. The United States, during the past 10 years, has been a net importer.

Whale oil is a direct competitor of edible oils in Europe. In this country, the excise tax of 3 cents per pound has practically eliminated its importation. Whale-oil production, which averaged nearly 600,000 short tons during 1935-39, may never again reach this figure. The whale population in the Antartic, the principal fishing ground, was being rapidly depleted before the war. An international agreement now limits the total annual catch to about half the prewar level.

Several other fats and oils furnish minor competition with soybean oil, but none are expected to play a major role in the near future.

If data were tabulated on the various fats and oils discussed above, the total would indicate that the 1946 world production is about 20 percent below the prewar level, and supplies now available for export are somewhat less than half of the 1935-39 average.

Many are interested in knowing what the prospects are for exporting soybeans and soybean oil from the 1946 crop and in future years. European countries could use several million bushels for crushing this coming winter. European mills are desperate for any kind of oilseeds to crush. They are not choosey and will accept any oilseed that is available. European countries wish to maintain their industrial plants and desire to continue crushing oilseeds because of the strong demand for oil cake and meal. These mills have no prospects at present for obtaining Argentine flaxseed or Indian or Chinese peanuts. England and France are obtaining some West African palm kernels and peanuts from their colonies, but oil mills in the Netherlands and in Denmark, as well as in several other countries, are ready to operate but have practically no raw materials available. In this postwar period, these mills will crush any oilseeds they can obtain and, naturally, those commodities which will produce oil and cake at the lowest prices.

The quantity of fats and oils available for international trade may remain below the prewar level for some years because several producing areas, such as India, may consume a larger quantity of their domestic production. On the other hand, the world import demand may not require so large a volume. Some countries may subsidize domestic production in order to reduce import requirements. Furthermore, Germany, formerly a large importer, may not be able to procure large quantities for some time. In several European countries, however, the demand should be strong because of a high industrial activity. The demand in Latin American countries may be at a higher level at least for a few years because of increased buying power. In the United States and Canada, postwar industrial activities should also create a strong demand for both edible and industrial oils.

World production of fats and oils is expected to expand during the next few years, despite the prospect that some decline in world prices may occur within that period. How long it will be before production exceeds demand at current prices depends upon many factors, such as: (1) Weather conditions affecting production in the major producing areas; (2) political stability in such areas as Manchuria and the Netherlands Indies: and (3) the ability of the deficit countries to finance their imports. Furthermore, if world prices advance to an abnormally high level, import requirements will shrink rapidly, and a temporary world surplus of fats and oils would appear likely. Nevertheless, a market for American soybeans and soybean oil at reasonable prices seems assured for some years.

SOYBEAN PRODUCTION IN *the Years Ahead*

By EDWIN G. STRAND
Bureau of Agricultural Economics

IN ANTICIPATING the future of soybean production in the United States over the next decade we must evaluate the forces that have been at work in the past and take stock of our present position. We must also try to distinguish and appraise the forces that are appearing on the horizon.

The story of soybeans in America in the 20th century is one of dramatic success. The record of progress is one of which the soybean industry and especially the pioneers in the introduction and improvement of soybeans and soybean products have a right to be proud.

Forty years ago only about 50,000 acres were grown for all purposes. If this acreage had been concentrated in one place it would have covered an area only a little larger than that occupied by the city of St. Louis. But the acreage grown in 1945 would have covered all the cropland in Missouri. Since the early part of the century work has been going on steadily in selecting and developing improved varieties, in accumulating and disseminating knowledge of improved techniques of production and processing, and in expanding the market for soybean products. Those who had faith in soybeans were a small group at first, but they increased in numbers and variety—finally including farmers, agronomists, chemists, processors, food manufactures, and many others. The industry was given additional stimulus by adjustments resulting from the droughts and the AAA programs of the 1930's and especially by the demands of war in 1942 and following years.

In 1945 the acreage harvested for beans reached a record high of almost 11 million acres. Since 1942 soybeans for all purposes have ranked seventh or higher in acreage of land occupied by American crops, exclusive of hay and pasture. The national average yield increased from a level of about 11 bushels per acre in 1924 to 18.3 bushels in 1944. The indicated yield this year is almost 20 bushels per acre. The soybean processing industry has grown from a few small plants in the early 1920's to about 140 plants at the present time with a total annual capacity of 180 million bushels or more.

The sharp increase in soybean production during World War II was brought about largely in response to the increased need for domestic vegetable oils to replace foreign supplies from which we had been cut off by the war and to meet our increased over-all requirements for fats and oils. It was widely recognized during the war that when peace should be restored—with the utilization of oils in war industries inevitably curtailed and with foreign oils again moving in international trade—there would probably be some down-

ward adjustment in soybean acreage and production. Another influence that would work toward that downward adjustment would be the desire of many farmers in the Cornbelt to return to more balanced systems of farming, with smaller acreages of intertilled crops and larger acreages of clover and grass. The wartime increases in both corn and soybeans came mostly out of land that had been normally in small grains, hay, and pasture. Corn and soybeans together occupied more than two-thirds of the cropland in some parts of the Cornbelt during the war.

The acreage of soybeans to be harvested for beans in 1946 is estimated at 9.4 million acres. This is 14 percent less than the acreage harvested last year. Several factors contributed to this reduction: (1) Many growers in the areas of most concentrated production had planned to reduce their acreage of intertilled crops immediately after the war in order to get back to a larger proportion of close-growing and soil-building crops; (2) for some months following V-J Day there was a general belief that prices for soybeans would decline in 1946; (3) the outlook for prices of feed grains and livestock was very favorable; (4) the appeal for grains for famine relief and the increase in ceiling prices for corn and wheat made at planting time increased the emphasis on these crops; and (5) a favorable planting season this year enabled farmers to put in large acreages of oats and corn.

CORNBELT REDUCTION

The reduction in soybean acreage this year is greatest, both relatively and absolutely, in the Cornbelt, where acreages of corn and oats have been substantially increased over last year. Reductions in soybean acreage are also reported in the Mississippi Delta, and in North Carolina. It is interesting, however, that there are substantial percentage increases in the fringe states of Minnesota, North Dakota, South Dakota, and Oklahoma, and in some of the other minor producing states.

In view of the world shortage of oils and fats and the strong demand for both oils and high-protein feeds in the United States, it is apparent that a much larger crop of soybeans this year would have found a ready market.

During the last 3 years soybean oil has accounted for 37 percent of the total production of vegetable oils from domestic materials. In 1944, for the first time, and again in 1945, the production of soybean oil in the United States exceeded the production of cottonseed oil. Most of our soybean oil is used in food products, but substantial quantities are used in industry.

It is estimated that food fats and oils for civilian consumption in the United States in 1946 will average about 41 pounds per capita, compared with 48 pounds in 1935-39 and a potential demand of at least 50 pounds (including actual weight of butter). Supplies of non-food fats and oils for civilian use are also far short of the quantities in demand.

The demand for fats and oils in the United States will probably be strong enough to support a domestic consumption of 10.5 to 11 billion pounds annually during the next 2 years, assuming relative prices like those in 1945 and continued high consumer incomes. To meet this demand, production from domestic materials would have to exceed by a substantial quantity the 9.4 billion pounds produced in this country in 1945. The world fats and oils situation is so tight that imports into the United States are not likely to reach the prewar level of 1.5 billion pounds before 1948. Therefore, until that time at least, with continued strong consumer demand plus the demand for supplies to rebuild stocks, there apparently would be a strong domestic market for fats and oils.

More than 95 percent of our production of soybean oil meal is used for feed. During the last 3 years soybean oil meal has comprised about 54 percent of the total oil meal fed to our livestock.

EDWIN G. STRAND

The outlook indicates a continued strong demand for oilseed meals during the next 2 years. Livestock production in the United States is still at a high level. Demand for livestock products is strong, and no major reduction in prices is likely during the next year or 2, unless there is a general business recession. Experience has shown that, with favorable prices of livestock products, feeders demand large quantities of high-protein concentrates.

With a high level of demand for vegetable oils and oilseed meals a crop of soybeans in 1947 as large as that of 1946 should bring a price at least at wartime levels.

The level of soybean production in the years farther ahead will depend upon the balance between the forces of supply and demand. As far as the grower is concerned this balance will be expressed in terms of the relative profitableness of soybeans and alternative enterprises on his farm. He may be expected to evaluate the crop from the standpoint of its contribution to his net farm income. This contribution will depend upon the direct costs of production, on the yields obtained, and on the price received for the crop. In addition will be his evaluation of any indirect contributions by the crop to his farm income.

The important factors in the price of soybeans are the prices of the two joint products—the oil and the meal. The prices of these products will depend on the general market situation for all fats and oils and on the market for high-protein feeds. These markets, in turn, will be affected by the level of economic activity and consumer incomes. In the present discussion it is assumed that at least a moderate degree of prosperity will prevail during the next 6 or 10 years.

Soybean oil found an expanding market in the food and industrial fields before the war. During the war its use in food products was greatly increased. Industrial uses were restricted by the government in order to divert a larger proportion into food channels. More than 50 different food products containing soybean oil are manufactured in this country. In 1945 soybean oil made up 47 percent of the total oils and fats used in shortening and 42 percent of the total in margarine. Much progress has been made during the last decade in methods of refining, bleaching, and otherwise improving this oil for food uses. In view of its wide acceptance in food products, and with continued improvement to be expected from current research, it seems reasonable to conclude that soybean oil will continue to hold a strong position in competition with other oils for food uses in the years ahead.

Its future in the industrial field may be even brighter. Because of the anticipated heavy demand for drying oils to be used in paints, varnishes, resins, linoleum, and oilcloth during the next few years and in view of the present low domestic and world stocks of these oils, it is probable that the volume of soybean oil taken by the drying industries will be considerably larger than ever before. This should be particularly true as the shortage of food fats and oils becomes less acute and as restrictions are removed.

The use of soybean oil in other industrial products has been materially increased since 1937 and may be expected to increase further as a result of new discoveries and improvements. A wide variety of relatively new industrial products such as Norelac and Norepol have also been produced from soybean oil, and its use in some of these may become important.

It has been demonstrated that by the process of fractionation soybean oil can be separated into two fractions—one that is faster drying than natural soybean oil and therefore more valuable for paints and varnishes and another that has a lower iodine number than the original and is superior for food uses. Application of this process on a large scale has significant possibilities of making available large volumes of these superior fractions at relatively low cost. This would be a decided stimulus to further expansion of both the edible and industrial markets for soybean oil.

PROTEIN FEEDS

An outstanding development in American livestock feeding in the decade before the war was the increase in consumption of high-protein feed per unit of livestock produced. This increase amounted to about 25 percent, and occurred although there was no appreciable change in the prices of such feeds relative to feed prices in general. This appears to represent a real increase in demand for high-protein feed as compared with the situation in earlier years.

But even at the relatively high level of protein supplement feeding attained in 1941-42 our livestock population as a whole was receiving only about 55 percent of the supplementary protein recommended by

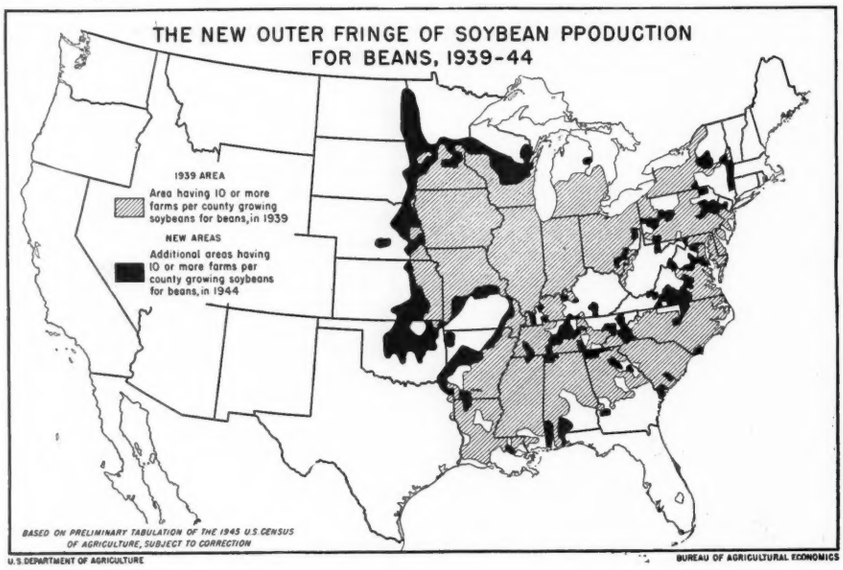
animal nutritionists. The greatest deficits, relatively speaking, prevailed in the case of hogs and poultry. Although during the war even greater quantities of high-protein feeds were fed per unit of livestock, the average was still far short of recommended nutritional standards.[2]

Soybean oil meal has found an expanding market at relatively favorable prices in competition with other vegetable protein concentrates. The quantity fed in 1941-42 was about 14 times as large as the quantity fed 10 years earlier, and by 1944-45 it was twice that of 1941-42. During the war this meal was used for the first time by a large number of feeders. Results wool), but competition from alternative materials will be keen.

The merits of soya flour have been demonstrated, and its use in premixed foods and for food enrichment may easily expand.

Even though industrial and food uses of soybean oil meal may be greatly increased, the principal use of the meal is likely to continue to be in livestock feeding. Its future in the feed market appears bright.

Farmers may be expected to grow soybeans to the extent that the crop makes a relatively favorable contribution to their net income, as compared with alternative crops. The relative price per bushel of


THE NEW OUTER FRINGE OF SOYBEAN PPODUCTION FOR BEANS, 1939-44
1939 AREA
Area having 10 or more farms per county growing soybeans for beans, in 1939
NEW AREAS
Additional areas having 10 or more farms per county growing soybeans for beans, in 1944
BASED ON PRELIMINARY TABULATION OF THE 1945 U.S. CENSUS OF AGRICULTURE, SUBJECT TO CORRECTION
U.S. DEPARTMENT OF AGRICULTURE
BUREAU OF AGRICULTURAL ECONOMICS

have been very satisfactory, and feeders have indicated that they will use it extensively in the future. Feeding experiments have shown it to be superior to other vegetable-protein concentrates for hogs and poultry. The greatly expanded mixed-feed industry has used large quantities of the meal in recent years. There is no doubt that soybean oil meal has become firmly established in the feed market.

In view of the prewar trend and the wartime experience in use of high-protein feeds it appears reasonable to assume an increase of 10 to 15 percent over the 1941-42 level in the quantity of these feeds fed per unit of livestock during the next decade, if the supply is available at about the same relative prices. Even if total livestock production should not be greater than that of 1941-42, the quantity of soybean oil meal used for feed could equal that used during the war, if it made up the same proportion of high-protein feeds.

Increasing quantities of soybean oil meal are likely to be used for industrial purposes in the years ahead. One of the most promising of these uses is in the manufacture of water-resistant and water-proof plywood glues. Such adhesives may find a substantial market in prefabricated housing and aircraft industries. There are also possibilities of using considerable quantities of soybean oil meal in plastics and fiber (soybean

2. **The Deficit in Protein for Livestock,** R. D. Jennings, Bureau of Agricultural Economics, U.S.D.A., April 1946.

soybeans as compared with that of corn, oats, and other competing crops is only a crude measure of this profitableness, for the returns from the whole farming system must be considered and this involves such factors as relative yields, growing costs, distribution of labor, the adaptability of various pieces of land in the farm to different crops, the general type of farming, crop rotation, and the desirable pattern of land use over a period of years. However, the relative price is very influential in deciding the total acreage of soybeans that will be grown in a given area. It is relatively easy to shift from soybeans to other crops, especially in the Cornbelt.

Preliminary data from the United States Census of 1945 indicate that there was a large increase in the number of soybean growers as well as in the acreage of soybeans for beans in the United States, from 1939 to 1944. Even in Illinois, which has long been in the lead in soybean production, the number of growers increased by almost one-third. Most other soybean-producing states also showed large increases in the number of growers within this period.

Perhaps the most striking development shown by preliminary data is the spread of soybean production to new areas along the northern and western fringe of the older area. This is shown in the illustration. The portion designated as "new area" on this map was drawn on the basis of counties having 10 or more farmers growing soybeans for beans in 1944, but which had less than 10 growers in 1939. In many of these counties the new growers numbered 30 to 100 or more. The "new area" is relatively narrow in most places, indicating that climatic obstacles to the northern and western expansion of the soybean crop are very strong. But it is believed to be significant that soybeans have been produced by a substantial number of new growers in this area in recent years. This area marks the present outer fringe in soybean production for beans in the United States. In view of the progress being made in selecting and breeding better adapted varieties of soybeans, it is possible that production in some parts of this area may increase in importance.

It is probably to be expected that the Cornbelt will continue to be the most important soybean-producing area in the years to come. A downward readjustment in acreage in this region is likely to come about chiefly through reducing the acreage per farm in the heavy producing cash-grain areas, but it will also be effected by reductions in acreage in the most important livestock-producing areas. It is expected also that soybean plantings will be curtailed on the more rolling lands. Growers in areas of tight soils, both in the Cornbelt and in the Delta, will be relatively less sensitive to a decline in soybean prices than will growers in areas of more versatile soils and with a wider range of alternative crops.

Factors that will tend to decrease the acreage of soybeans from the present level are:

1. Additional readjustment from wartime use of cropland on many farms—decreasing the intertilled acreage and increasing the acreage in so-forming legumes and grasses.
2. Availability of gradually increased supplies of other vegetable oils at competitive prices.
3. Increased competition from improved higher-yielding varieties of oats.
4. Use of new improved varieties of cotton, peanuts, and sweetpotatoes and new corn hybrids in the South.

Some factors that will work in favor of a large acreage of soybeans in the years ahead are:

1. The relatively greater profitableness of soybeans as compared with small grains for cash sale.
2. The beneficial effects of soybeans on the yields of corn and small grains planted in rotations.
3. The usefulness of soybeans in corn-borer control.
4. The advantage of the crop in seasonal distribution of labor.
5. The adaptability of soybeans to mechanized farming.
6. The increase in number of farmers having experience with soybeans.
7. Progress in development and adoption of higher yielding, better adapted varieties in the southern as well as in the northern states.
8. The need for a larger variety of crops in the South.
9. The interest of large processing and mixed-feed industries in the soybean crop.
10. Continued research aimed at improving the quality and expanding the fields of use for soybean oil and meal.

It is apparent that many of the factors and forces that have facilitated the remarkable progress of the soybean industry in recent years still have considerable momentum and will therefore be influential in the years ahead.

GOVERNMENT PROGRAMS

for Soybeans

By CARL C. FARRINGTON
Assistant Administrator, Production and Marketing Administration

• The soybean industry is rapidly being released from government control. There will be no renewal of Commodity processing contracts. An early termination of set-asides and limitation orders is contemplated. Farrington was closely associated with Commodity's soybean program during the war years.

I SHALL discuss briefly the soybean programs that we have carried out in the past and give the picture as we in the Department of Agriculture see it at this time with respect to the 1946 and 1947 programs.

During the last 4 years, the government has played a most important role in the production, marketing, financing, and processing of the soybean crop. Even in 1941, some attempt was made to increase the harvested acreage of soybeans through the announcement of a loan program. It was not until 1942, however, that an allout production program was launched. For that year the government announced a support price of $1.60 per bushel—a price approximately double the price that had prevailed during the immediate prewar years. Farmers responded enthusiastically. The acreage harvested in 1942 jumped to 10 million acres, as compared with an average of 4 million acres during the previous 5 years. Production in 1942 totaled 187 million bushels, approximately two and one-half times the average production for the previous 5 years.

In order to carry out its price support commitment, the government offered loans to farmers, it made purchases from farmers, and through elevators and most important of all—entered into contracts with processors under which they agreed to pay not less than support prices for all soybeans purchased.

In 1943, the support price was increased to a basis of $1.80 per bushel and production increased in that year to 193 million bushels. In 1944, 1945 and 1946 the base support price was $2.04 per bushel and production has been maintained at near the 200 million bushel level.

SUBSIDY LOSSES

During each of the years from 1942 to 1945 the situation with respect to support prices on the one hand and the prices for products on the other hand made it necessary for the government to incur substantial losses in carrying out the soybean program. The subsidies involved over the 4-year period totaled approximately 100 million dollars. I am sure that we will all agree, however, that these subsidy payments were a small price to pay for the contribution that soybeans have made to the war program.

On the other hand, the war period has brought to the soybean industry many changes and improvements which might have been delayed for many years in the absence of wartime demands.

After the government became involved in the marketing and processing of soybeans, it became evident that soybeans could not be properly valued to processors without a determination by chemical analysis of the oil content of the soybeans being sold. Accordingly, the government with the cooperation of the industry and laboratories has developed techniques for the sampling and analyses of soybeans for the purpose of determining the price of such soybeans to processors. A wealth of interesting and valuable information has been acquired through these analyses. I hope that some time soon there will be an opportunity to make a thorough analysis of the data that have been accumulated and that the results of this analysis may become available to all.

Many people have known for some time that the oil content of soybeans varied somewhat from year to year and from state to state. Those variations have been attributed to varietal differences, differences in soil, differences in length of growing season and to various climatic influences. Surprisingly, our records indicate that the average oil content of the soybean crop varies only slightly from year to year. The average of the 1943 crop on a 14 percent moisture basis was 17.3 percent, the average of the 1944 crop was 17.4 percent, and the average of the 1945 crop was 17.4 percent.

These averages, however, do not reveal the really significant variations that exist each year as between states and within states. Unless both buyer and seller know at least approximately the oil content of a lot of soybeans, a true value of the soybeans cannot be determined. It is important, therefore, that producers, dealers, and processors—with the cooperation of government—continue the work that was started during the war with respect to the analysis of soybeans, and try to project ways and means of relating market prices to the oil content of soybeans.

MOISTURE CONTENT

Under the government programs the moisture content of soybeans has been more completely recognized as a value factor than had been customary in the prewar period. It has long been known that a soybean with 10 percent moisture has a greater value than a soybean with 14 percent moisture. But it was not until 1943 that premiums were paid to farmers on the basis of moisture content—although it had long been a custom to make a discount for high moisture content.

The government will, of course, continue its interest in seeing that farmers get a reasonable price for their soybeans. For the current year there appears to be little doubt but that the entire crop can be marketed at or above support prices without extensive governmental operations in the marketing or processing of soybeans. However, Commodity Credit loans will be available to any farmers who wish to take advantage of these loans, and purchasing operations can and will be inaugurated by the government should this become necessary in order to fulfill the government's commitments to farmers. The government is required by law to support the prices of soybeans for at least 2 more years at not less than 90 percent of parity or the comparable price of soybeans.

No determination has been made thus far as to the exact support price for 1947, but I am sure that it will be one which is

(Continued on page 66)

SUMMARY OF PROCESSING OPERATIONS UNDER COMMODITY CREDIT CORPORATION CONTRACTS — 1942-1945 CROPS

(Bushels processed)

Location of Processing Plants	1942 crop	1943 crop	1944 crop	1945 crop[1]
Midwest	103,240,056[2]	116,105,333	136,459,834	139,911,369
Southeast (Midwest beans)	7,933,108	5,964,873	2,989,222	1,258,316
Southwest (Midwest beans)	9,055,804	14,561,836	4,573,162	3,162,609
Cotton States	7,245,982	5,203,181	5,360,565	7,567,948[2]
Pacific Coast	3,258,004	2,425,642	1,706,735	3,139,888
TOTAL	130,732,954	144,260,865	151,089,518	155,040,130
Base Support Price (No. 2, 14% Moisture)	1.60	1.80	2.04	2.04

1 Crushed and controlled as of June 30, 1946.
2 Based upon report from Bradley 3-13-46 of purchases of Midwestern beans by Southern Mills.
3 Includes 5,019,813 crushed at East Coast Mills.

Soybean Diseases in the Cornbelt Region in 1945

By WILLIAM B. ALLINGTON[1]

LOSSES FROM soybean diseases were considerable in the Cornbelt in 1945. The new disease which was first observed in a few fields in central Illinois in 1944 was very severe in some sections of the Cornbelt in 1945. It has been named "Brown Stem Rot" and is caused by a fungus which has not yet been named. Total losses were sustained in a few fields in central Illinois, and the damage in several counties in that area was conservatively estimated at 10 percent.

The fungus apparently exists in the soils of the Midwest and infects the soybean plants either through the roots or at the base of the stem near the soil surface. Soybean plants growing in the greenhouse in naturally infested soil obtained from diseased fields usually become infected if grown under proper conditions of temperature. The disease has been produced repeatedly in greenhouse experiments by inoculation with the specific pathogenic organism responsible.

Temperature conditions have a marked effect upon the symptoms produced and the time at which they appear. Artificially inoculated plants growing in culture chambers with air temperatures between 55 and 65 degrees F. usually die before blossoming time. If the temperature is maintained above 70 degrees F. the plants will appear relatively free of disease and mature more normally. The development of the disease is therefore considered to be dependent upon low air temperatures such as are generally found in the field each fall. The rate of development of symptoms is remarkably rapid under conditions favorable for the disease.

The interior of the stems of infected plants has a brown coloration (Figure 1), starting at the base of the plant and speeding upward, sometimes nearly to the tops. The plant stems may be weakened before maturity in the fall and severe lodging of the plants is not uncommon. Complete lodging is characteristic of infected plants before they have reached the stage when they may be combined. The top leaves of the plants may be blighted suddenly, making the field assume a scorched appearance almost overnight (Figure 2).

Control measures for brown stem rot are not yet known. Observations indicate the possibility that fertility of the soil may affect the damage but accurate data on this point are still lacking. Tests are now under way to determine the effect of nitrogen, phosphorus, and potash fertilization on the incidence and severity of brown stem rot.

Bacterial blight was a serious disease of soybeans in 1945. This disease causes serious damage to the leaves often leaving them in a torn and tattered state similar to damage caused by hail. Apparently the cool season in 1945 was conducive to rapid development of bacterial blight since its ravages extended over the entire area in this country where soybeans are grown. In the variety tests in 1945, where a search for resistance was made, only slight differences were found between varieties.

The bacterial pustule disease was less severe in general during 1945 than in previous years. This is usually the most damaging of the leaf diseases. Effective resistance has been found in a southern variety and a breeding program is under way to incorporate this resistance into varieties suitable for each of the soybean growing areas.

The bud blight virus disease was less severe in 1945 than in previous years. Apparently the cool season was less conducive to the spread of the virus which possibly is carried by a specific insect. No resistance is known for this disease although a large number of varieties have been tested. An intensive study is being carried on at the present time in an effort to find an insect vector responsible for the transmission of this virus.

The work of the U. S. Department of Agriculture on soybean diseases is proceeding along rather fundamental lines at present, since this is a necessary prerequisite to a sound basis for attempts at control. The field of soybean pathology, as a whole, has been greatly neglected in the past and the lack of fundamental knowledge regarding the nature and behavior of these diseases is plain. It is hoped that these efforts will soon lay a foundation on which specific practical recommendations for disease control can be based.

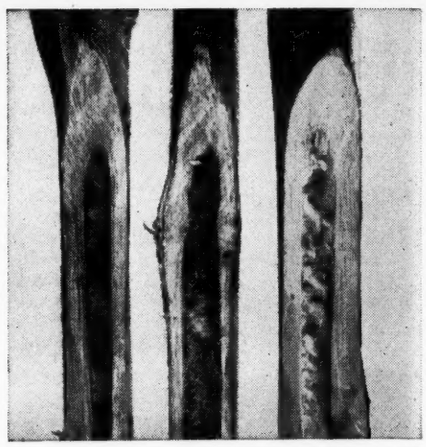
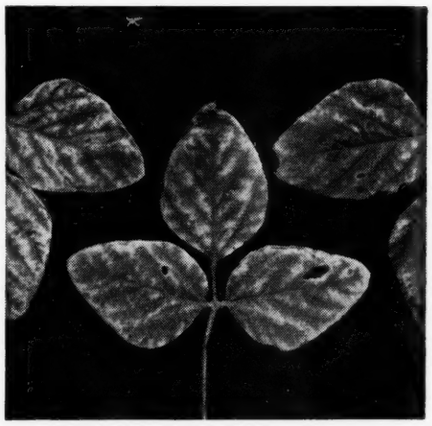


Figure 1. Internal stem symptoms produced by the brown stem rot disease. The diseased stems show extensive internal browning.



—Illinois Agricultural Association Record

Figure 2. Leaf symptoms produced by the brown stem rot disease. Note the dead areas which may appear very rapidly.

1. Pathologist, Division of Forage Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, U. S. Dept. of Agric. (On staff of U. S. Regional Soybean Laboratory until Oct. 8, 1945.)

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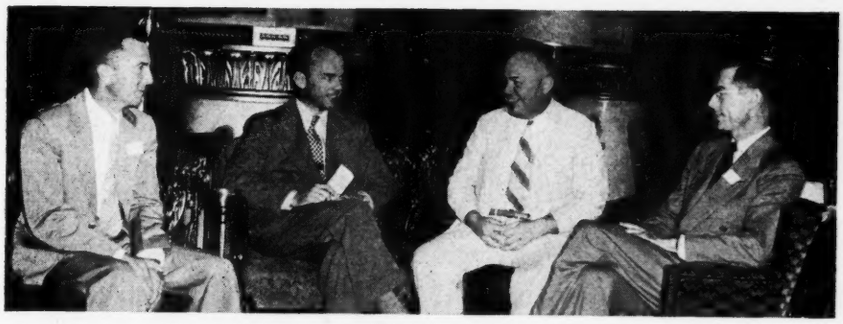


Some of the men on soybean disease work who attended the convention. From left to right: Dr. Donald W. Chamberlain, U. S. Regional Soybean Laboratory, Urbana, Ill.; J. M. Crall, pathologist for the University of Missouri and agent of USDA; Dr. Howard W. Johnson, Bureau of Plant Industry, Beltsville, Md.; and Dr. W. B. Allington, U. S. Regional Soybean Laboratory, Urbana.

Organization of

SOYBEAN DISEASE RESEARCH

in the U. S. Department of Agriculture

By W. J. MORSE and H. W. JOHNSON[1]

SINCE July 1, 1945, when additional funds were made available by Congress to the Division of Forage Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, U. S. Department of Agriculture, for soybean disease investigations, plant disease specialists have been employed at a number of strategic locations in the United States to carry on a coordinated program of pathological research. The organization that has been set up is outlined briefly in the following paragraphs.

Since the Cornbelt is the major soybean producing area of the United States, first consideration has been given to organizing the work in that region. Dr. William B. Allington, plant pathologist of the U. S. Regional Soybean Laboratory, was assigned to the new project on October 8, 1945 as a coordinator of the soybean disease work in the Cornbelt. He retained his headquarters at Urbana, Ill., where he works in close cooperation with the Illinois Agricultural Experiment Station and the staff of the U. S. Regional Soybean Laboratory. On January 14, 1946, Dr. Donald W. Chamberlain was appointed at Urbana, Ill., to work with Dr. Allington on the numerous soybean disease problems being investigated there, thus continuing and broadening the research program at this location.

Other centers of investigation have been established in cooperation with the state agricultural experiment stations and agricultural colleges of the Middle West at the following locations: Columbus, Ohio; Lafayette, Ind.; Ames, Iowa; Columbia, Mo.; Madison, Wis.; and St. Paul, Minn. Fungus bacterial and virus diseases of the soybean are being studied by this staff of trained investigators and their work is being integrated closely with that of the plant breeders, both state and federal, engaged in producing new, superior soybean varieties.

It is believed that through this coordinated program of breeding and disease research, improved disease-resistant soybean varieties will eventually be made available to the growers. This will provide a disease control measure that is now largely lacking to soybean producers.

A second major soybean-producing area is the South, especially the Delta region of Mississippi, Arkansas, and Louisiana. Consideration has been given also to organizing the work in that region. A coordinating center for the soybean disease work in the South has been established at the Delta Branch Experiment Station, Stoneville, Miss., which is likewise the headquarters of the work of the U. S. Regional Soybean Laboratory in the South. Dr. Howard W. Johnson has been assigned to this position as coordinator of the soybean disease work in the South.

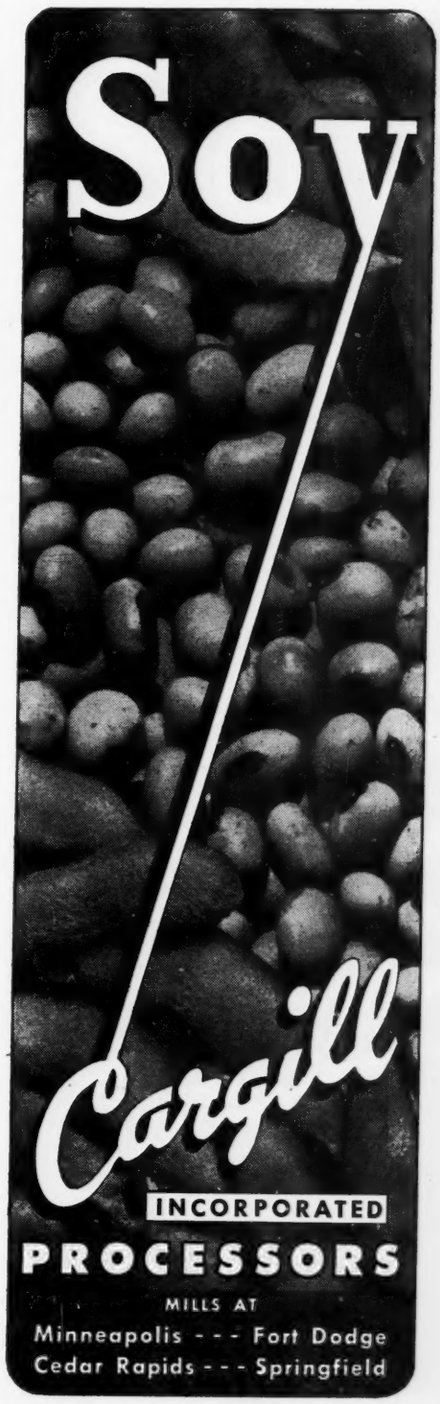
Other centers of investigation have been established in cooperation with the state agricultural experiment stations and agricultural colleges of the South at the following locations: Raleigh, N. C.; Experiment, Ga., and Baton Rouge, La. Rootknot, southern blight, and other diseases of the soybean are being investigated in this region.

Here, as in the North, the plant disease studies are being closely integrated with the work of the plant breeders with the objective of producing improved, disease-resistant soybean varieties.

Over-all coordination for the entire program is supplied from the national headquarters of the Division of Forage Crops and Diseases at Beltsville, Md., by Dr. J. Lewis Allison, head of our project on forage crops diseases. Research on soybean diseases is conducted at this location by Dr. C. L. Lefebvre, who has been assigned part time to the soybean disease project.

In summary, we feel that during the past 14 months an adequate organization has been set up and qualified personnel have been employed to make possible a vigorous attack on soybean disease problems in the major soybean producing areas of the United States. This organization has been integrated closely with existing state and federal organizations devoted to soybean breeding and disease work. It is believed that through this enlarged, coordinated program faster progress will be possible in developing control measures for soybean diseases, particularly through the development and release to the growers of improved, disease resistant soybean varieties.

(1) Principal Agronomist and Senior Pathologist, respectively, of the Division of Forage Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, U. S. Department of Agriculture.



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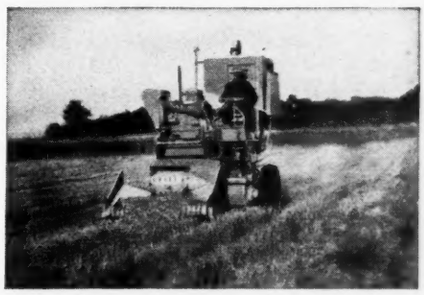

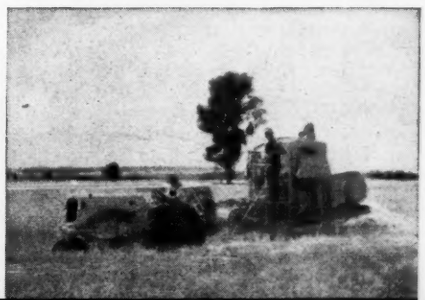

MINNEAPOLIS-MOLINE POWER IMPLEMENT COMPANY

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FOODS

SOYBEAN OIL

Its Future in Margarine and Related Products

• *The author recommends a campaign of education to acquaint farmers with the true uses of soybean oil. Since 1939 he has been general sales and advertising manager of the package products division of Durkee Famous Foods. He is former chairman of the executive committee of the National Association of Margarine Manufacturers.*

By N. BETZOLD

WE ALL recognize the wide community of interest shared by the American soybean growers and the margarine industry. During recent years there has been a lively and progressively increasing interest in soybean oil as an ingredient for margarine and related foods.

Your objective is the same as ours, and that is to extend the use of the products we produce or raise. Certainly, extending the use of soybean oil in human food is a most worthy goal.

We in the margarine and edible oil field have given this problem a great deal of consideration, and I am glad to have this opportunity to report to you what we are doing and intend to do in the future to increase the use of our products, and the general usage of soybean oil.

As we see it, there are two major phases to this problem:

1. Research—and a continuation of the quality improvement of the past 10 years.
2. Opening up the consumer market through the removal of restrictions.

First, I would like to tell you what we in the margarine industry are doing about soybean oil research.

The margarine industry sells "tastiness and flavor." *Our product must please the consumer's palate.* We have learned from experience and through numerous consumer surveys that margarine must have a mild, sweet, fresh flavor. This flavor must be carefully guarded throughout the manufacturing processes, and the channels of distribution, including wholesale and retail outlets. It must be stable and hold up for a reasonable period of time so that it reaches the consumer at its "flavor peak."

PROCESS SIMPLE

The process of making margarine is simple, although many people think of it as a very complicated one. We must start with a bland, sweet, neutral and stable, edible oil. To this we add cultured pasteurized skim or whole milk, and table salt. These ingredients make up more than 99 percent of the total, the remainder being made up of lecithin, glycerine derivatives, etc. used to improve frying qualities.

A great many safeguards are thrown around these materials as they come to the margarine plants—they are rigidly tested before being processed—recording thermometers are affixed to every storage tank, pasteurizing and processing machine to make sure that uniform temperatures prevail. Men who have devoted their lives to the processing of edible oils, sample and test these products many times daily to make sure that flavor is being properly guarded.

After the oils and milk have been mixed and emulsified they are congealed, plasticized, then formed into 1-pound prints after which they are wrapped in parchment paper and paraffined cartons made of special food board.

We must take these precautions because flavor is our business.

CHOICE OILS NEEDED

In order that we may place in the hands of the consumer (who will in the final analysis determine the future of the soybean oil in the edible field) a product that will please her palate, we in the food and particularly in the margarine industry, must have available to us an ample supply of choice domestic vegetable oils. We are committed to a domestic oil policy about which I will comment more in detail later on.

We have to have available in this country the kind of oils we need to make the margarine consumers prefer. We need more such oil and I am sure we can improve these oils as we go along. As everyone knows, great progress has been made in the development of soybean oil during the past few years, and this progress has been particularly rapid during the past 5 years. Refiners, through their own research departments, have improved their processes during these years. Techniques have been improved. Improvements in flavor and stability have followed.

However, the margarine industry, probably more concerned with the business of *selling flavor* than any other, felt that a *broader* and a *better co-ordinated* research program should be set up on an industry-wide basis. In 1944 it established a project and foundation for this purpose at the University of Pittsburgh under the direction of Dr. Herbert E. Longenecker, dean of the School of Natural Science, and a leader in research.

The facilities of a goodly number of universities and large laboratories were investigated before this foundation was established at Pittsburgh. We selected Pittsburgh because Dr. Longenecker's department was adequately staffed and also because ample facilities were available to carry on this work. Further than that, this project dovetailed well with other work being done there on flavors. The foundation is set up on a 3-year basis now.

It is hoped and anticipated that this program will be enlarged and that the Margarine Association will be joined by other industries in this effort to improve still further the present fine qualities of soybean oil. We have every confidence that this work will produce results.

Even in its present state of development soybean oil has attained a prominent position in the margarine and shortening fields. The increased usage of soybean oil in margarine only is shown by the following figures:

1932	5,000 pounds
1933	7,000 pounds
1934	24,000 pounds
1935	1,740,000 pounds
1936	14,261,000 pounds
1937	31,791,000 pounds
1938	39,885,000 pounds
1939	70,822,000 pounds
1940	87,103,000 pounds
1941	75,634,000 pounds
1942	133,346,000 pounds
1943	198,020,000 pounds
1944	211,105,000 pounds
1945	206,643,000 pounds

Source: Bureau of Internal Revenue.

In the case of shortening and oil, the following tabulation shows the increase in usage since 1940:

1940	212,317,000
1941	215,967,000
1942	335,555,000
1943	568,405,000
1944	620,257,000
1945	683,011,000

Source: Bureau of Census—Facts for Industry.

Almost 900 million pounds of oil were used in margarine, shortening and oil

(Continued on page 61)

SOY FLOUR

War Usage and Peace Prospects

• *Mr. Leger is executive secretary of the Soy Flour Association. He formerly administered the soybean contract for Commodity Credit Corporation.*

By A. E. LEGER

THE THIRD largest outlet for the soybean is soy flour.

Soy flour has many commercial uses. A few of the major products in which it is used are:

Bakery products
Prepared mixes
Meat products
Confections
Macaroni and spaghetti
Soups

Soy flour has sold for nearly two decades but only in recent years has there been substantial increase in volume. A steady broadening field of usage has marked these later years.

There was a period when corn had but a single use. Soy flour is following the normal pattern of development, which involves diversification and consequently wider acceptance, with an increased number of outlets.

Like other new food products, soy flour had a difficult time getting into the highly competitive field. Even the term "flour" is misleading. It is not a flour in the sense of wheat or rye flour. It is a non-glutenous highly concentrated vegetable protein which is more nearly comparable to dried milk or dried powdered eggs. The protein content ranges up to 53 percent in the defatted type of soy flour.

Soy flour has had greater appreciation in Europe and the Orient because they recognized its nutritional benefits.

When preparing for World War II Germany imported volumes of soybeans from the Orient through Russia before the outbreak of hostilities between the two nations. Much of this supply was converted into soy flour. This gave the Germans a natural concentrated food which was used in the "food pills" that formed so important a part in the German soldier's ration. Germany claimed that her advance into Poland and Russia could not have been so rapid had it not been for soy. A soldier easily carried a 3-day supply, with additional supplies more readily transportable and storable than animal foods or bulky tinned rations. Italy and Spain also used soy flour, obtained by reason of their association with Germany.

You are all familiar with the age old story of the miracle bean and its development and use in the Orient. The Chinese speak of it as the poor man's meat, the cow of China, and the meat without bones. The Japanese speak of it this way—"if we could have held Manchuria, it would have guaranteed that Japan could never be starved out."

There has been marked improvement in the quality of soy flour. Scientific research has made it possible to surmount earlier difficulties. Standardization of soy flour has been accomplished.

The Soy Flour Association approved and adopted standards with specifications for each type soy flour—full fat, low fat and defatted. These names refer to the amount of oil retained in the product.

Full fat soy flour is not processed for oil extraction, so it contains all of the fat originally found in the soybean, amounting to over 20 percent. Because of the large percentage of fat it is higher in calorie content than the low fat or defatted types.

Low fat soy flour is made by a continuous mechanical pressing method in which the greater part of the oil is removed.

Defatted soy flour is made by a solvent process and contains less than 2 percent fat.

Soy flour can be prepared with color ranging from creamy yellow to nearly white and flavors ranging from mildly flavored to toasted or nut like.

During a flavor acceptance test by several public institutions of the state of Illinois 3,787,498 meals were served with soy flour bread and rolls, in which a total of 715,999 pounds of such bread and rolls were consumed. Meals were served cafeteria style. If an individual did not like a certain item he was not required to take it. Likewise if second helpings were desired, it was served.

So far as the individual seemed to know, nothing in particular had happened to the bread one way or another when 5, 6, and even 7 percent of soy flour was added for 30-day periods.

Exhaustive and careful analysis of volume consumption figures summarized showed a general satisfactory, or better than satisfactory, consumption of bread containing soy flour. There were comments such as "it doesn't tast so flat as the bread we had before."

The lack of food protein results in a related lack of blood protein. When this condition exists we are more susceptible to infectious diseases. Soy flour with its high protein content adds nutritional qualities to the diet.

In a recent research project three biological methods were used to evaluate the nutritional quality of the protein present in white bread containing 3 percent and 5 percent soy flour. The results showed that white bread containing 3 percent soy flour was equal to white bread containing 3 percent milk, and the 5 percent white soy bread was at least equal to 6 percent white milk bread.

In addition to the comprehensive research projects carried on in the laboratories of soy flour manufacturers, numerous projects are now under way, or have been completed, at the University of Illinois, Purdue University, the University of Minnesota, Kansas State College, Pittsburgh University, Mid-West Laboratories, the U. S. Regional Laboratories, and at

SOY FLOUR STANDARDS

	Full-Fat Soy Flour	Low-Fat Soy Flour	Defatted Soy Flour
Protein (Nx6.25)*	40.0% Min.	45.0% Min.	50.0% Min.
Protein (Nx5.7)*	36.5% Min.	41.0% Min.	45.0% Min.
Fat (Ether Extract)*	18.0% Min.	4.5% Min. 9.0% Max.	2.0% Max.
Fibre*	3.0% Max.	3.3% Max.	3.5% Max.
Moisture	8.0% Max.	8.0% Max.	8.0% Max.
Ash*	5.5% Max.	6.5% Max.	6.5% Max.

Screen — 97% thru No. 100 U. S. Standard Screen for each of the above.
* Moisture free basis.

DEFINITION

The products shall be processed from high quality, sound, clean, dehulled yellow soybeans. The soybeans shall be subjected to a thorough initial cleaning operation that shall substantially remove all foreign material. Disagreeable flavors and odors shall be removed by subjecting the soya material to adequate processing.

Soy flour shall be prepared and packaged under modern sanitary conditions and in accordance with the best commercial practices.

The soy flour shall be free from burnt, musty, rancid or other undesirable flavors or odors; free from burnt, scorched, or grayish color; and free from insects, insect webbing, dirt, or other extraneous matter.

other public institutions. As an industry, we are determined to have all the facts on soy flour. And the more facts that are brought to light, the brighter becomes the outlook for the future of this superior food product.

The confectionary industry is using soy flour in research to improve candies nutritionally. Already it is an ingredient in fudge, caramel, kisses and crunch type candies. Its use contributes to better emulsification of the fats used in the manufacture of candy and tends to prevent drying out of the finished product.

A successful conclusion was reached with Food and Drug Administration for the use of soy flour in macaroni and spaghetti. A wheatsoy macaroni or spaghetti product may now be made with soy flour added in a quantity not less than 12½ percent of the combined weight of the wheat and soy ingredients.

SOY FLOUR IN SAUSAGE

The most recent major success for soy flour was the action of the Federal Bureau of Animal Industry permitting its use up to 3½ percent as a recognized binder in sausage manufactured in federally inspected houses. This recognition took years of hard work. Denial had been based principally on the argument that because the protein of soy flour was so much like the protein of meat a test had not been evolved which would accurately determine the quantitative content of soy flour in sausage. Time and again we contended that accurate tests did exist. One by one the objections were eliminated on the basis of findings of the government experts. The American Soybean Association, as in other instances, gave assistance and cooperation toward a happy conclusion.

This victory for soy flour has been brought to the attention of all the states in the union, with our recommendation that they also make like change in their meat regulations. The response has been enthusiastic. Most states have already adopted soy flour as an accredited binder in their meat regulations. Diligent effort is being directed toward the few remaining states, and it is expected they will join forces with the majority in the near future.

As soon as a state incorporates soy flour in its meat regulations, the same program is repeated with any city in that state reported as not following the trend. All of the cities contacted have promptly made the necessary change.

Work has already begun on a brief to be filed with the Food and Drug Administration in our determination to have soy flour included as a optional ingredient up to 3 percent in the new standards for white bread, rolls and buns. There is no doubt but that a hearing would have been held by now if it were not for the advent of the wheat flour 80 percent extraction order and our willingness to cooperate with the baking industry by deferring action until after the wheat flour emergency.

UNRRA has long recognized the nutritional value of soy flour and required substantial quantities to fulfill obligations to starving peoples. Soy flour, because it is a nutritious food of high protein content, has added immeasurably to UNRRA's efforts to alleviate malnutrition and starvation in foreign lands.

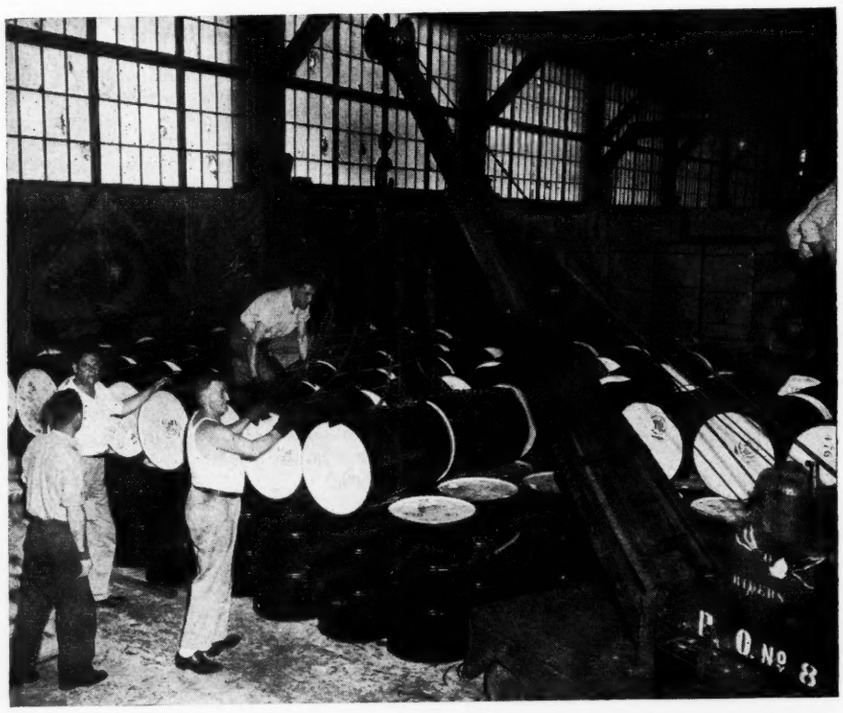
Soy flour was used as a protein base in dehydrated soup sent to China, from whence came our original soybean breeding stock.

Soy flour had been sent from the United States in 1945 to 32 countries for use in bread and other food products. Probably a larger number of countries will receive soy flour in 1946.

An interesting mission was formed recently composed of 25 church denominations with representation in all foreign countries. On the theory that hunger breeds war, they plan to supply a meal free of charge to the poor throughout the hunger belts. The developed meal is a little package containing 2 ounces of a mix that provides 400 calories at a cost of approximately 2 cents. The basic ingredient of these meals is soy grits.

The Veterans Administration, Bureau of Prisons, and the School Lunch Program are other fields for soy flour which are being developed.

There is no doubt but that soy flour is deeply rooted in the American diet. It is recognized as a permanent food. Its future is secure. It has been winning its place on sheer merit. All efforts will be coordinated to develop volume distribution along with the progress of research.



—USDA Photo by Forsythe.

Drums filled with soybean oil are hoisted from the dock on board the ship that will carry this highly concentrated food to a famine-stricken country across the sea.

Soy Flour in the
UNRRA FOOD PROGRAM

By DONALD S. PAYNE
Food Technologist and Consultant
Washington, D. C.

• *The author has been connected with soy food programs in various governmental capacities for a number of years. In 1945 he resigned his position as soy food expert in War Food Administration to help set up the UNRRA program in Europe.*

AS MANY of you remember, soya flour was planned for relief feeding purposes back in 1943. Naturally there was no concerted relief effort until after the war in Europe. With the formation of UNRRA there came an increased interest in soya flour and products containing soya. As usual the interest met with the well known objections, flavour and acceptability predominating.

It was soon apparent within few months after the relief and rehabilitation job started in Europe that the large sums of money appropriated would not be large enough to do the feeding job and it was necessary to consider lower cost foods, more grains and even substitutes. So soya came back into the picture in a big way.

At this point we must understand how UNRRA works. Each relief country has had the initial privilege of requesting the types of foods most needed. These requests are screened by the local UNRRA representatives and then submitted to Washington Headquarters for action. Of course each country requested more meat and dairy products than would have been

possible to procure in the U. S. A. or the world for that matter.

Then UNRRA turned to soya in an effort to solve this problem. The U. S. Department of Agriculture said it could procure millions of pounds at about 5 cents per pound. UNRRA wired each relief country advising that no more meat or dairy products could be had because of excessive cost and short supply. Would they therefore be interested in an alternative protein food in the form of soya flour or food mixtures containing soya? Replies were very poor—"they didn't like it"; "they didn't know how to use it"; "it was a 'Nazi' food"; "no good"; "had too much cereal already"; "could they get samples?"

LEFT OVER FROM LEND LEASE

Finally the countries began to show some interest when they actually did not get delivery of the more expensive protein foods, but they still did not request delivery of soya. Agriculture had some excess stocks of soya flour left over from lend-lease orders and the UNRRA officials decided to buy it and ship sufficient quantities to each country to see if it could be introduced into the diets on an experimental scale.

It was then decided to send someone over to demonstrate and encourage the use of these excellent food materials. Accordingly UNRRA requested that I be released from Agriculture to make the trip to each country and explain the advantages of soya and the methods of using it in the various diets.

In order to round out such work it was decided that Miss Isabel Keenleyside should also visit each country and assist in the demonstration of soya products as well as other foodstuffs that were then available although not generally consumed. Miss Keenleyside was suitably trained for such work as she is a graduate of Ontario Agricultural College where she majored in dietetics and nutrition. After graduation she was in charge of dietetics in hospitals, hotels and institutions. She was later the head food buyer of the T. Eaton Co., Toronto, Canada, largest chain of department stores in the world next to Marshall Field's. At Eaton's she purchased all food supplies for the restaurants, bakery shops, ice cream manufacturing departments, etc. She is now assistant chief of the meat and dairy products branch of UNRRA, which includes soya products as well as soups because they are alternates for the meat proteins. She has been with UNRRA for 2½ years.

One to 10 pound samples of soya flour (full fat and low fat) grits soup, stew mix, soya milk, canned horse meat, canned blood pudding, etc., were sent to each country so that they would arrive prior to our arrival.

The trip all over Europe was made from August 1945 through November 1945. We were well received in all of the relief countries—Italy, Greece, Yugoslavia, Poland and Czechoslovakia, by the then prevailing government officials. They all seemed anxious to convince us that what they really wanted and needed was more meat, milk and cheese. Politely as possible, we told them they weren't going to get milk, meat and cheese—(1) because of cost and (2) because there wasn't any. After much discussion we then arranged regular cooking and sampling demonstrations including actual bakery tests in their own bake shops using 5 and 10 percent additions of soya flour (both low fat and full fat).

DEMAND PICKS UP

When the officials found that soya wasn't so bad—in fact found it was good and that they liked it and in some instances preferred it, the requests started to come in. Italy took 8,000 tons a month, Yugoslavia, 10,000 tons a month, Greece, 5,000 and so on.

Of course in each case we were careful to point out that soya was good nutritionally too. We found that as a rule they already knew about that and were primarily interested in how to use it. As many of you know the Germans had studied and exploited soybeans and soya food products for many years. In some countries we found that one reason they didn't want us to send soya flour to them was because soybeans were all they had had to eat during periods of German occupation. We wouldn't like it either under those conditions.

The demonstrations were successful and the various countries decided to include 5 to 10 percent soya flour in their bread and to use as much soup (containing 25 percent soya) as was possible. Some countries such as Czechoslovakia planned to use 3 to 5 percent in all sausage.

A word about full fat soya flour. Many investigators and consumers in this country prefer full fat flour for use in bakery products. For this reason it was demonstrated in each relief country alongside of low fat soya flour. In some instances it was preferred. However, had any of the countries taken full fat flour they would have had to decrease the small amount of fats and oils they were scheduled to receive by the amount of fat contained in the full fat soya flour. For this reason they decided in favor of the low fat flour. As a matter of fact at the 5 and 10 percent levels in whole wheat bread baked under conditions as they were it really did not make much difference. Since there has been some criticism for not shipping more full fat flour (or beans) I thought it might be well to point this out. Also the primary reason for introducing soya flour was to increase the high quality protein content of the diet, not the calories. The final total purchases and distributions of soya flour and dry soup powder to the various countries through June 1946 is as follows:

SOYA FLOUR & GRITS

	Net Pounds
UNRRA Procurement	292,000,000
Shipments through June 1946	118,000,000

	Million Pounds
Czechoslovakia	23.3
China	23.3
Greece	16.4
Italy	23.1
Poland	10.1
Yugoslavia	21.6

DRY SOUP

	Net Pounds
UNRRA Procurement	149,600,000
Shipments through June 1946	82,000,000

	Million Pounds
Austria	2.7
Byelorussia	.6
Czechoslovakia	3.2
China	20.3
Greece	11.1
Italy	16.4
Poland	16.7
Ukraine	9.8
Yugoslavia	.1

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It should be noted that many of the countries did not take all that was originally requested. There are two reasons for this:

(1) Some of the countries found the task of introducing a new food ingredient too difficult for the limited trained personnel available. We should have arranged for trained personnel or soya experts to have been members of the UNRRA staff in each country so that a more thorough job could have been done.

(2) UNRRA was unable to buy for quick delivery the large amounts finally requested.

This was due to the fact that the soya flour industry had for a long time held back on the sales of soy meal in anticipation of the large relief demands prophesied by Agriculture and in truth had finally given up hope of assisting in the job of feeding the world. It sold its soybeans as meal and oil and prepared to return to normal soybean processing operation. Therefore, when the large demand for soya flour was placed, our industry was not able to respond as rapidly as was desired. It did a magnificent job however, and is to be complimented for its willing efforts in expanding its capacity and the ready expenditure of large sums of money in an attempt to help feed the world with a new and outstanding product.

The contribution of the soya flour industry to the world food supply during the war (lend-lease) and through the efforts of UNRRA is large. The following total figures of lend-lease and UNRRA purchases will probably give you for the first time some idea of how big it really was:

	Lbs.
Lend-lease, soya flour and grits	412,200,000
Soya contained in soups, stews, other food products	44,000,000
Lend-Lease Total	456,200,000
UNRRA soya flour	292,000,000
Soya in soups, etc.	37,000,000
UNRRA Total	329,000,000
Grand Total	785,200,000
	or 392,500 tons.

This total is equivalent to 17-18 million bushels soybeans, and also may be considered equivalent to the protein content of over 1 million tons of meat. Now we know that probably not all of this soya was properly utilized in the way it should have been, but the soya industry and you growers have made available to the starved and hungry people of the world a new source of food. A protein food of high nutritional value that would not have been available nor used if not for the tireless efforts of your own representatives and a few scattered persons in government.

THANKS TO GROWERS

You have contributed well and the world owes you a vote of thanks. I only wish I could bring that vote to you now. I can't. You won't get it for a long time. The job is not yet done nor does the world even appreciate what has been done.

The soybean has been called the "Miracle Bean", "Wonder Bean", and Heaven knows what else. In my opinion it is none of these. It is rather one of the most basic crops this world has. It is a low cost, easy to raise, newcomer that needs lots of attention from our diplomats as well as our chemists. The chemists, medical men and industrial men have all proven it is a good food.

We know now that the U. S. A. cannot feed the world and ourselves too. UNRRA cannot do the job either. It is necessary to pursue further the work you men have made possible and have so well started. The people of the world are still hungry. They will be for a long time. A few of us who have studied the problem have realized that soybean foods properly blended with wheat, corn and other low cost foods such as peas and beans provide a base diet that even at today's prices in the United States can feed a person completely for a cost less than 15 cents a day. Medical tests have proven its value.

Here is a start for the world! Feed the people well! It can be done and if they are properly fed then we may possibly look forward to a happier world with less strife and discontent. We might even start to consider having a peaceful world. At least it is worth thinking about. I for one intend to be doing something about it.

As many of you know, UNRRA plans to close all operations in Europe this December and to close operations in China by March of 1947. In fact it has already started curtailing its operations. This means that the export of soya flour and products through Washington will come to a stop except for the individual efforts of the various companies and a certain few citizens mindful of the world needs. I should think that here is a problem worthy of some specific action. An organized export sales effort by the combined forces of growers, processors, and flour manufacturers would be in order and in my opinion should be considered now.

FEEDING THE WORLD *with Soya*

By DR. HARRY W. MILLER

SOYBEAN production has extended so rapidly the past decade into many corners of the world, that encouraging a worldwide dependence on it nutritionally may not seem presumptuous.

The world for years has been facing a very acute nutritional lack, with millions of people either starving or half-starving. Even in peace time there were millions showing signs of being undernourished and dying of malnutrition because of the lack of satisfying portions of protein. There is no more weakening and disease inviting situation than that observed among people robbed of essential protein. It is the first requisite of nutrition.

H. W. MILLER

Rob the people of oil and starches and they may show lack of energy and emaciation to a considerable degree, but if they are getting the requisite amount of protein they can continue to live and carry on. In protein they have the essentials for growth, the essentials for tissue repair, the essentials to fortify against bacterial invasion, and they have the essential nutrient portion necessary to maintain all of the organs of the body in harmonious balance and action, providing for those vital fluids that are to sustain every individual cell of the body.

Loss of protein in the diet cannot be supplanted by either oils or starches, no matter in what abundance they may be found. The individual will show lowered resistance, stunted growth, and will go into a state of exhaustion. We are today aware of the building up powers of protein liquid such as blood plasma and blood transfusions. Proteins conveyed to the individual supplying the need of vegetable amino acids are given orally and parenterally today with almost equally phenomenal results.

COMPARED WITH OTHER PLANTS

Well prepared soya foods in the diet will create the same response. I cannot go into detail regarding the particular biologic values of soy protein. But it comes the nearest of any one article of food to supplying all the requirements of proteins in human and animal nutrition. Its growth and worldwide utilization, therefore, become of primary importance at the present time.

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But that's only one saving of a Massey-Harris Self-Propelled Combine. There's the saving of fuel by using only one engine to both operate and propel the machine. There's the saving of time . . . of cutting more acres . . . the ease of handling . . . of shorter turns.

Add to these important savings the continuous delivery of more grain to the grain tank, the result of the cleaner separation which a Massey-Harris always gives you, in more than 110 different crops.

The Self-Propelled Combines are but one of many advancements in farm equipment that Massey-Harris has pioneered and developed since 1847. Straight through separation, rasp-bar cylinder, power-plus tractors, high speed plows, the Forage Clipper that handles any hay or ensilage crop are but a few.

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THE MASSEY-HARRIS CO.

General Offices, Racine, Wis.

Let us take wheat and corn for instance, and measure them with soybeans as a food. It will first be noted that the soybean's economic value as a food has not been fully evaluated in the markets in this country. Let us grant that the value nutritionally of soy protein is on an equality with corn and wheat, which of course we know it is not. Soy protein excels. We have in the soybean an average of 40 percent protein, while corn has 10 to 12 percent and wheat 11 to 14 percent. Wheat and corn are not primarily oil and protein bearing foods. They are made up mostly of starch and are classed as fuel foods.

The average cost of producing an acre of either wheat, soybeans or corn differs little. Let us make some calculations of the nutritional relief afforded by these three crops based on the comparative yield per acre. In good agricultural districts we look for a yield of 1,500 pounds per acre for wheat, 1,500 pounds for soybeans, and 2,500 pounds of shelled corn per acre.

According to the present markets for protein, oil and carbohydrates, we find that we are paying eight times as much for the protein portion of our diet as we pay for a similar portion of carbohydrates. We pay three times as much for oil as for carbohydrates. Present prices of vegetable protein average about 40 cents per pound, oil 15 cents per pound and starches or carbohydrates 5 cents per pound.

One hundred pounds of soybeans yield approximately 40 pounds of protein and 20 pounds of oil. Corn will yield approximately 10 pounds of protein, 2 pounds of oil and 75 pounds of starch. Wheat yields 12 pounds of protein, 2 pounds of oil and 75 pounds of carbohydrates. On the basis of the above figures, 100 pounds of soybeans has a market value, nutritionally, of $19 as compared with $8.85 for wheat and $8.05 for corn. (The figures were made up 2 weeks ago and may not apply today, but are all right for comparison.)

Genuine Soy Sauce

Famous cooks and expert chefs insist on La Choy Sauce not only in making genuine Chop Suey, Chow Mein, and other Chinese dishes, but also in frying steaks, chopped meat, meat balls and hashes — in making gravies and stews — for serving on the table as a condiment for steaks, chopped meat, roasts, chops, croquettes, Spaghetti, fried eggs and sea food.

LaChoy Food Products, Archbold, Ohio

Division of Beatrice Foods Company

The figures give a nutritional value of $285 per acre for soybeans, while an acre of wheat will yield $132.75 and an acre of corn $201.25.

We find that the greatest nutritional relief can come from an acre of soybeans. Corn is next and then wheat. An acre of soybeans will go as far as 3 acres of wheat and 2 acres of corn, based on what it takes in cash to buy the protein, oil and starch requirement. It will be recognized that this ratio in nutritive value as between wheat, corn and soybeans has not been reflected in the present day market. We are receiving for soybeans, wheat and shelled corn practically the same price, all being purchased for a little over 3 cents per pound. When it is considered that the yield of corn is almost double that of wheat or soybeans, the premium crop for the farmer today is corn.

We are hoping that the market for these field crops will reach a price more nearly in harmony with the nutritional values found in these three crops. When we do we will find that there will be a price for soybeans about double that paid for corn. I am sure that we will see a market trend in the future along these lines.

VEGETABLE PROTEIN VS. ANIMAL PROTEIN

When we calculate supply and cost of animal protein and oil as compared with soybeans as a source of protein and oil the differential is much greater still. For example, $6.50 will purchase enough soybeans to yield 100 pounds of protein and oil on a dry food basis. If we wish to get the same values nutritionally from cow's milk, eggs or meat, you will have to recognize the tremendous increase in cost. Based on market costs, it will take $50 worth of milk to provide 100 pounds of dried food, or bought from the creamery in pints, half-pints and quarts, the cost would be three times as much, nearly $150 for 100 pounds of milk solids.

The average run of meat, beef, pork and mutton, and various cuts and preparations of meat yield approximately 20 percent protein and 10 percent oil, or just half that contained in a pound of soybeans. In other words, you have to take 2 pounds of meat cuts in order to have the nutritive value contained in 1 pound of the soybean. The cost is $180 for 100 pounds of protein in meat, since it is necessary to buy 3 pounds of meat in order to get 1 pound of food solids, as meat is over 60 percent water.

In the case of eggs, it takes 60 dozen eggs to weigh 100 pounds, or 210 dozen medium sized eggs to yield 100 pounds of egg powder at a cost of $126.

When you consider what it costs to produce milk, egg or meat solids, the reason for these figures is plain. Taken on an average, a cow will eat 800 pounds of food units in order to yield 100 pounds of nutritional units in the form of milk solids. To produce the meat it requires between 1,100 and 1,200 pounds of feed to yield 100 pounds of tissue storage in the animal made available as food.

I am going into these facts and figures somewhat to call attention to the economic losses in time of food scarcity in feeding the nutritious legumes and grains to livestock to get the small nutritional returns. In countries like America this has been very possible and people may continue to get their protein supply this way chiefly because of our large agricultural resources.

But in the thickly populated portions of the earth nutrition must of necessity come direct to the people from vegetation. These people have for centuries been forced to live on foods directly obtained from the soil. It is possible that these facts that I have given were in the mind of the Secretary of Agriculture when he issued a few months ago a request to the American people to send their wheat and corn to the starving people of other lands rather than feed them to pigs and cows and sheep of this country.

PROCESSED SOYA FOODS

In the third of the world's population not accustomed to soya foods there is a psychological prejudice to overcome. I am glad to say today it is solved.

Many companies, recognizing the unpopularity of the word "soya", worked on the plan of incorporating it into other foods, particularly soy flour used in various products in order to enrich and extend them. Defatted and whole soy flour has been incorporated with wheat flour by bakers and housewifes into bread, biscuits, cookies, crackers and other bakery products such as cakes and pie crust. In 10 to 20 percent proportions, it has yielded improvement in quality and added to its nutritive value.

One of the latest breakfast foods, which bids fair to become one of the most popular, is made by a 50-50 combination of soy flakes and corn grits run through a shredder and toasted. Its crisp and nutty flavor recommends it as an appetizer as well as a decided improved nutrient. This cereal has nearly 20 percent protein.

Soy flour has become very successful in the manufacture of noodles. It has been used as an extender for bologna, hamburgers, sausage and incorporated in a very large number of recipes for meat loaves. In all these instances a little soya adds better flavor and higher nutritive yield. For all of these products the ordinary field variety of the soybean can be readily used.

It also can be announced today that the newer methods of manufacture and the better understanding of the utilization of the soybean enable us to adopt many of the field varieties into the edible group. In fact, most of the types of soybeans that have the white hilum can be readily utilized for edible purposes. It is commonly believed that further experimentation will enable soybean food producers to take the ordinary varieties of soybeans and make tasty foods very similar to those now processed from the edible group.

OTHER FOODS

We have a still much larger list of foods that today are made directly from the soybean. In these the soybean must stand on its own merits and it has proved acceptable to 90 percent of people sampling it. The large edible soys are now becoming available the world over. The canned mature beans, when properly processed and flavored by a suitable vegetable bullion or with tomato sauce, are very acceptable. It must be remembered that soybeans contain three times the quantity of protein and nine times the amount of oil found in either peas, lima beans, lentils or the ordinary navy bean.

The green edible soybean offers an additional line for canneries and freezing plants

packing peas, lima beans, corn and other vegetables. It also offers another tasty item to the cook to adorn the dinner plate.

Green soybeans can be canned with exactly the same equipment that all canneries have and can be shelled with the same sheller that is used for peas. The canning season is not in conflict with that of any other product unless it be sweet corn. The varieties can be planted so that they will not seriously interfere with this product. There is nothing we can put into the cans exported to other countries and for the areas of large population of our own country that will give people greater returns nutritionally than the immature green soybean. It has a nutty flavor and does not in any way harbor the beany taste that lingers in the minds of some people who think of soy foods.

CANNED SPROUTS

Canneries could develop a very fine winter industry by canning soybean sprouts. Or the frozen food people could very well add a package of frozen soy sprouts to their lines. These could very nicely come into our markets as a fresh vegetable along with brussel sprouts, lettuce and other raw foods, to be incorporated into salads and cooked dishes. The sprouting of the soybean again removes the characteristic taste and gives a nice vitamin-yielding food, along with its rich content of minerals. Any good field variety may be used for sprouting.

There is much to be learned from the Orient regarding usages of soybeans in the diet, in the many forms in which they prepare them. They first make a water extraction of the protein, curdle it and make cheese. With this bean they can make foods simulating milk, fish, fowl and meat in appearance and taste.

Already, in this land hundreds of infants have been started from birth using modified soy milk. A very large group of others who are allergic to animal milk are substituting soy milk for the dairy milk. It is being made into varieties of delicious cheeses, and has possibilities in the cheese industry the equivalent of cow's milk curd. The lactic acid soy milk is the most pleasing beverage. The acidity of the milk covers wholly any semblance of the characteristic beany flavor.

ALBUMEN SHEETS

We now have albumen powder made from the soy extraction flakes utilized like egg powder by the big candy industry in ever increasing amounts. The soy albumen sheets, because of their labor and painstaking requirements, have not been made in this country as they are in China. However, we are finding ways of providing for their manufacture.

A halt has been made on the production in Michigan of a competitive margarine called soy butter. Still, there is available to every housewife a method of making a butter with far less work than churning cow butter. Such a butter is made from soy oil and soy milk which is colored with carotene oil and salted to taste.

Dry mature soybeans can be readily transported to any part of the world without requiring refrigerator space. They are a form of concentrated nutrition the world can easily be taught to use. Seventeen dollars worth of soybeans at 5 cents per pound will supply enough protein for a family of five for an entire year.

In a paper such as this it would seem to be in place to give a few concrete suggestions on what might be done to help solve the world food shortage.

1. Encourage more soybean production in America. This could be done if soybeans were given their proper economic value.

2. Forward seed to various countries in the world, encouraging its production through helpful instructions in growing, processing and using. There are very limited areas where soybeans have proven entirely unsuccessful when given a fair trial.

3. We should devote more time on experimental work in cooking and preparing the food and overcoming any objectionable features that seem to prevent its widespread use. The feeble efforts that have thus far been put forth have really done wonders in furthering the adoption of the soybean in the diet.

In closing, allow me to say that with the present world yield of soybeans, if used exclusively to relieve human starvation, relief could come to all the destitute areas of the world.

—s b d—

BETZOLD

(Continued from page 52)

last year. This accounts for about two-thirds of the total annual production of soybean oil.

We in the margarine field are most anxious to broaden the market and increase the usage of all domestic vegetable oils and I am sure that most of you read the announcement released by the National Association of Margarine Manufacturers which was authorized by the Association as a whole on June 21. This announcement as published in the August *Soybean Digest*, stated:

"The experience of World War II has shown to the people of the United States that even in this Nation, acute shortages of basic foods and materials can develop almost overnight. Every American knows about the shortages of such everyday essentials as sugar, tin, rubber and also fats and oils.

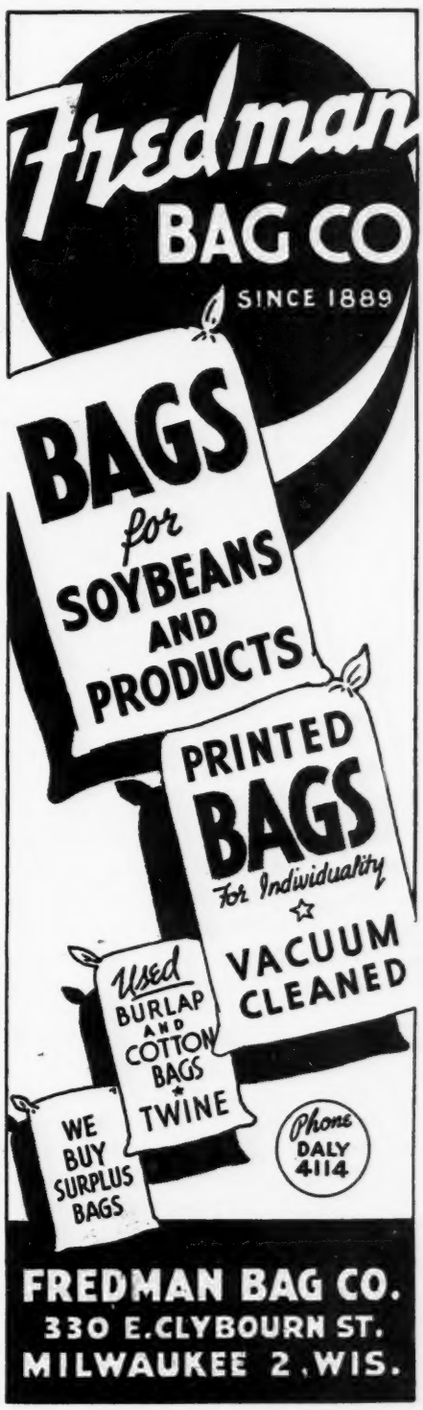
"One lesson learned by this experience is clear. America must, in time of peace, insure plentiful supply. When an emergency comes, it is too late. Margarine is a pure, nutritious and palatable food which, in recent years has been made exclusively from domestic fats and oils. During this period, margarine has become increasingly popular with the American people. From the American farms come the fats and oils used in margarine: Cottonseed, soybean, peanut, and corn oils and meat fats. If it had not been for these American farmers and their tremendous productive efforts, the shortage of margarine today would be substantially greater.

"The members of the National Association of Margarine Manufacturers strongly believe it to be in the best interests of the American farmers and consumers that a dependable and ready source of supply of margarine should be assured at all times. They announce, therefore, that they intend to continue to utilize only domestically produced fats and oils in the manufacture of their product."

Summarizing Point No. 1, therefore, the future of soybean oil in margarine and other edible products depends largely upon how well we *please the palate of the consumer.* A great deal of progress has been made in this direction. Research can lead us to greater improvements and a greater market. We will pursue this course aggressively.

The second phase which is of equal importance is that of opening up the consumer market. Even though we have a top quality and economically sound product, the full benefits of this product cannot be realized by the country as a whole, unless that product has a free and unrestricted market.

The fact that consumers want margarine is clearly demonstrated by figures which show that despite these restrictions, domestic margarine consumption has in-



creased from 264 million pounds in 1934 to 503 million pounds in 1945. Almost nine out of 10 Americans have tried it. People have tried modern margarine and found it good—they praise it openly—the public attitude has changed. All this despite the restrictions which now hold back its ready and rightful sale.

LEGAL BARRIERS

Here is what we mean by restrictions:

Nine states charge a manufacturer's license fee of $1 to $1,000 yearly.

Fourteen states charge a wholesaler's license fee of $1 to $1,000 yearly.

Twelve states charge a retailer's license fee of 50 cents to $400 yearly.

Seven states charge a per pound excise tax on all margarine of from 5 cents to 15 cents per pound.

Twenty-four states bar the sale of colored margarine.

Thirty-seven states place additional restrictions on hotels, restaurants, bakers, confectioners, boarding houses and domestic households.

I am referring to state laws only.

In addition, we have the following federal laws:

Ten cents a pound on yellow colored margarine and one-fourth cent a pound on uncolored margarine.

Federal license fee of $600 on the manufacture of all margarine.

From $200 to $480 per year wholesaler's license, from $6 to $48 a year retailers license.

Only 40 percent of the retailers in the United States handle margarine. The remaining 60 percent find it too difficult or unprofitable to sell margarine under these restrictions.

Visualize the wide consumer market which would be opened to soybean growers, cotton farmers, growers of peanuts, corn, hogs, etc., if these restrictions were removed.

Modern margarine is a product of the American farm and is entitled on the basis of its performance and record, to fair access to the consumer market.

Probably the greatest impediment of all is the restriction which requires margarine manufacturers to sell their product in an unnatural white state while at the same time the natural color is yellow. This statement seems to surprise many people. Nevertheless it is true. The natural color of soybean oil and many other oils is yellow.

NATURAL COLOR

Here are samples of soybean oil in its various stages: First the crude sample as it comes from the expellers or crushers. You will see it is golden yellow in color. This next sample of bleached oil is almost watery white in color. Practically all of the natural color has been removed. This next sample of the hardened oil is hydrogenated and refined soybean margarine oil which, when manufactured into margarine, produces a white margarine.

Article 12 of Regulations No. 9 governing the sale of margarine states:

"For the purpose of subsection (a) and of section 3, oleomargarine shall be held to be yellow in color when it has a tint or shade containing more than one and six-tenths degrees of yellow, or of yellow and red collectively, but with an excess of yellow over red, measured in the term of Lovibond tintometer scale or its equivalent."

In order to comply with this provision soybean margarine oil must be bleached to a pale white like the sample just shown. When the above reading is exceeded, margarine is deemed to be yellow and therefore taxable at the rate of 10 cents per pound.

Natural red and yellow tints are present in a great many vegetable oils such as cottonseed, corn, peanut, oleo oils, etc. Margarine can be made naturally yellow, but it would still be necessary to use some artificial coloring to standardize shades and produce a uniform product, as is necessary in butter and other food products. You all know that winter butter is very light in color, some of it practically white. In order to make the product more attractive and in order to please the palate of the consumer, butter is artificially colored most months of the year. To emphasize this point further I would like to read you several ads which appeared in the *Creamery Journal* published by the Buttermakers Co., Waterloo, Iowa. "All dressed up and plenty of places to go. Dress up your butter with — — certified butter color and it will be in constant demand. It gives you maximum coloring at minimum cost."

Here is another sample, "In the race for consumer acceptance pale, weak looking butter falls behind." "Two pounds of butter placed side by side in front of the consumer may be of equal high quality—of equal flavor and aroma—of equal cost. But let one pound be pale and colorless and the other rich, golden yellow, and you will find the latter to be the choice of nearly everyone. That's because the consumer expects every pound of but-

Swift's Soybean Oil Meal

Swift's Soybean Oil Meal makes all livestock and poultry say "Wow! What good feed!" And so feed manufacturers, feed mixers and feed dealers prefer it in their mixed feeds. You'll find it will help build your business by bringing in new customers and repeat orders from old ones. Remember (1) it's a good source of high-quality proteins and other important nutrients. (2) It adds taste-appeal to all mixed feeds. (3) It gives the right balance to your formulas. (4) It is always uniform in quality and gives dependable results.

When buying Soybean Oil Meal from . . . or selling soybeans to . . . Swift & Company, you can always rely on Swift's prompt, friendly service.

SWIFT & COMPANY

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Des Moines, Iowa Fostoria, Ohio Blytheville, Ark.

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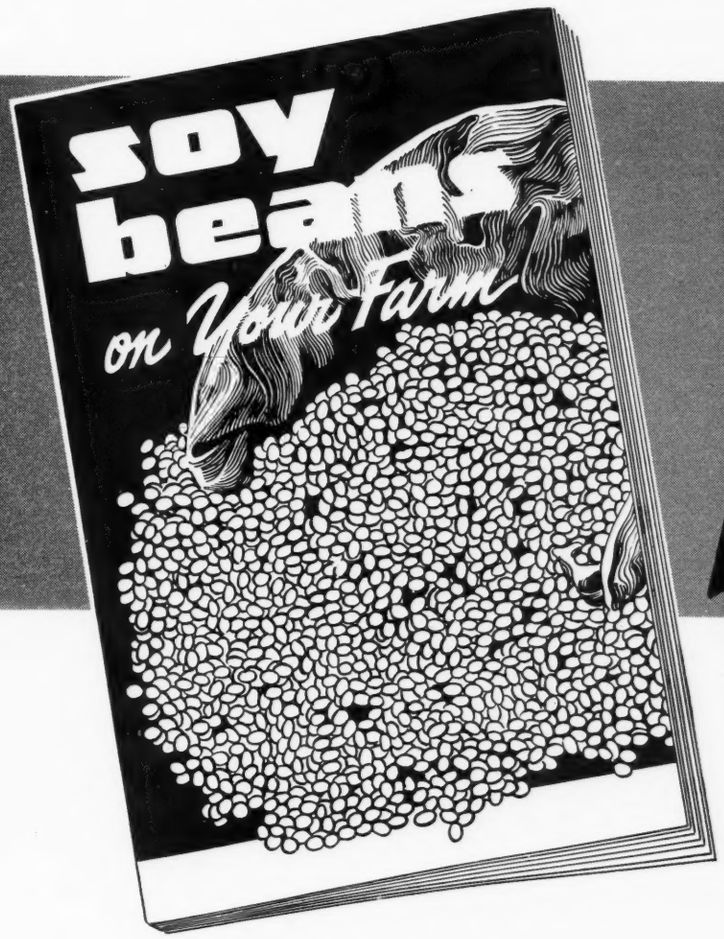

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Know the latest findings on soil erosion—weed control—solid versus row planting and many other important factors.

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Please send me a copy of *"Soybeans on Your Farm."*

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ter to be June shade regardless of the month."

Now there is absolutely nothing wrong about artifically coloring foods. It is done to *please the palate of the consumer* and to make food products more appetizing and attractive. Colored cellophane is used on hundreds of foods simply to make them appealing to the buyers. Oranges, ice cream, candy, cherries and many other food products are attractively colored, not to increase their food value, not to deceive the consumer, but to make them more attractive. People can be made to eat more nutritious foods if they are made to appear attractive through color.

To show you how color helps eye appeal, I have here a display of many foods you see and eat daily. Every one of them is artificially colored.

It is sometimes said that we should color margarine red or pink or green. This is not an honest answer to the problem. It avoids the real issue.

Yellow is not the private property of any particular food. Yellow is widely associated with richness in foods. The fats, eggs, the yellow hue of poultry makes it a desirable and appetizing color. Prepared foods such as baked goods, cakes, pies, cookies and biscuits are in most cases naturally yellow in hue. The color of many prepared fish is yellow. Macaroni, egg noodles and cheese all fall under the classification of yellow.

MANY FOODS ARE YELLOW

In the vegetable line we have corn, beans, squash and others, all of a yellow hue.

In the line of fruits we have lemons, pineapples, pears, bananas, apples and many others all in the yellow family.

It certainly would not be fair to ask that these foods be bleached an unnatural white because they are naturally yellow.

Generally speaking, yellow is the most desirable of all hues associated with foods. Without sunlight many of these foods could not grow.

Margarine is naturally yellow in color and it should be sold yellow to please the palate of the consumer.

Certainly you would not ask that blueberries be colored an unnatural green nor would you require red meat to be dyed blue.

Margarine should be sold in its natural yellow color with the privilege of standardizing through the use of artificial coloring — the reason being, first, to *please the consumer's palate;* secondly, to *save the consumer's time* now wasted in coloring margarine in the home; and thirdly, as a plain, ordinary *matter of fair play.*

At the outset I stated that the soybean growers and margarine manufacturers have a wide community of interest. How, then, can we help each other so that the greatest benefit can be derived from this wide community of interest?

We as margarine manufacturers can continue to make the best product we know how to make, to distribute it efficiently and to promote it energetically. We can direct our research work to build a still greater market in the future.

You as growers can help us to bring about removal of these restrictions which surround the free sale of margarine.

I believe that if the average farmer knew that two-thirds of the total soybean oil produced was used in margarine and shortening, he would be much more concerned about the removal of these restrictions.

Recently one of the large food manufacturers conducted a survey in selected counties in four leading soybean producing states. The counties selected were Sangamon County, Ill.; Allen County, Ohio; Tippecanoe County, Ind.; and Marion County, Mo. The purpose of the survey was to ascertain the actual thinking on the part of soybean growers on the subject of margarine and soybean oil in general.

The following general conclusions were outstanding in the results of the survey:

1. THE AVERAGE FARMER HAS GIVEN LITTLE THOUGHT TO THE USAGES OF THE SOYBEAN OIL WHICH HE PRODUCES ON HIS FARM.

2. The smattering of knowledge which he has on the subject of the oil usages does not include an awareness of the fact that margarine is one of the large usages of the oil. Less than 5 percent of the farmers interviewed had ever heard that margarine was made from soybean oil. Fully 80 percent of the farmers were surprised to learn this fact. Approximately 75 percent of the farmers interviewed mentioned paint first in thinking of the oil usages.

3. Farmers, as a general rule, like to grow soybeans. However, this fondness is primarily engendered by the profitableness of the crop. Approximately 90 percent of the farmers interviewed were firm that soybeans would remain as a permanent crop in the economy of their area — "but only as long as they remain profitable."

UNINFORMED ON OIL USAGE

4. Farmers are by no means well informed as to what the legislative restrictions on margarine are. Over 90 percent of the farmers interviewed had no idea as to what the specific restrictions on margarine were.

It is evident from these conclusions that a great deal needs to be done to acquaint growers with the importance of margarine as a market for the oil in their soybean crop.

When asked about the oil usages, most farmers answered spontaneously, "paint." Another common answer was "plastics." Still another response included "parts for Ford automobiles." About 18 percent of the farmers included "food products" in their responses.

The farmer has relatively little interest in the oil usage because by the time the oil is ready to be used the product has long since left his hands. The beans have been sold and the financial transaction has been completed. He now has no further financial interest.

This being the case, it is clearly indicated that something must be done to educate the farmer about the importance of margarine and shortening and oil as the most important outlets for the production of the soybeans he grows.

Farmers like to grow soybeans—they are a good cash crop—they lend themselves to mechanical farming. Labor requirements fit well into their total picture.

Obviously, the farmer has not carried his own thinking through and that is where the American Soybean Association can help.

The interviews did disclose that once the farmer's stake in the margarine picture has been explained to him his sense of fair play and good sound business judgment comes to the surface and he is willing to do something about it.

It is my opinion that the American

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Soybean Association is a most valuable organization to spearhead this educational drive.

Inasmuch as most soybean growers lose contact with their product after they have delivered it to the elevator, it would seem that the elevator people should also be educated on the importance of margarine and shortening and oil so that their interest would be reflected back to the grower. The grower's contact is the elevator—hence, we should educate the elevator operators.

There is also one other misconception which I would like to take the opportunity here to clear up, and that is that many growers believe that in working for the removal of these margarine restrictions they are irritating the dairy farmers who are their best customers on meal.

DAIRY USE NOT MAJOR

This is clearly a misconception because all facts lead in the direction that the *oil*, and the *non-dairy* outlets for meal, provide by far the larger share of the net return to the farmer, as against the meal which goes into dairy feeds.

The uses for meal are generally broken down into the following: swine, chickens, turkeys, ducks, sheep and lambs, and beef cattle and dairy cattle. Cottonseed oil meal and linseed oil meal have been used in large quantities in the last years in swine rations and we expect therefore, the percentage of soybean oil meal to be correspondingly less in such rations.

In the case of chicken, turkey, and duck feeds, soybean oil meal runs as high as 60 or 70 percent of the total. Cottonseed oil meal is not used to any great degree in poultry rations because of its effect in egg quality and the use of linseed oil meal is limited generally to not more than 5 percent of the total ration. It is reasonable to assume, therefore, that soybean oil meal furnishes a larger portion of the vegetable protein in rations of this kind.

All of these figures are estimates as no official tabulation has ever been prepared.

Twenty percent would seem to us to be a reasonable figure covering the percentage of vegetable protein supplied by soybean oil meal in beef cattle and dairy cattle regions. In the Southwest many of the range cattle receive nothing but cottonseed and linseed oil cakes. Cottonseed and linseed are likewise popular in dairy feeds in many sections of the country.

It would, therefore, seem that the largest market for the meal rests in the use for feed for swine, laying chickens, broilers, turkeys and ducks with the poultry feed field leading all others by a wide margin.

As to the value of the oil in the beans, there are approximately 10 1-2 pounds of oil in a bushel of beans. At the OPA ceiling price of 11 3-4 cents per pound for the crude oil, the value per bushel would be about $1.23. The relative market values of oil and beans vary from time to time but over a period of years I think it would be safe to say that 55 percent of the farmer's net income on beans results from the oil as against 45 percent from the oil meal. During the war with ceilings on both oil and meal, the valuations as established by the government were on about a 55 oil—45 oil meal basis.

The purpose in citing these facts is merely to clear up any misconception that the part of the oil in the total soybean picture is of the lesser importance.

Getting back to the main topic of the future of soybean oil in margarine and related products, I again want to emphasize that the future is bright and that it is good. The National Association of Margarine Manufacturers is promoting margarine as a product through national advertising.

In 1946 the program includes six full pages in *Life Magazine* and the same amount of space in *American Weekly*. Next comes *Parents Magazine* with over 800,000 readers, all interested in good nutrition for children. The home economics field is thoroughly covered by three publications.

Added to this is the large amount of paid advertising done by manufacturers. The story of margarine is being unfolded to many millions of people.

Nine out of ten people have tried margarine and found it good. Modern margarine is on the march.

Margarine is willing to place its case before the bar of public opinion and let the consumer be the judge.

I want to say again that the American soybean growers and the margarine people have a wide community of interest. We can be not only *an* outlet, but the *largest outlet* for soybean oil you have.

We will do our part by expanding our *research* to new fields, for a greater market.

We would like your support in *opening up this market* so that the consumers and the growers all will benefit.

Our objectives should be the same:

1. Research and the continuation of quality improvement.
2. Opening up the consumer market.

Last to be demobilized

DEATH by high explosive stopped a year ago, and people said the war was over. Demobilization came with a rush, but not for the American farmer. Despite four bumper crops, raised without adequate help or machinery, the battle for food was far from over. Starvation didn't stop simply because of papers signed in Tokyo Bay.

Today 500,000,000 people face death by starvation. These lives can be saved if food reaches them in time. Food from fertile, productive America remains their main hope—food grown by the American farmer, and carried to shipside by the American railroads.

The amount of wheat alone which the railroads have delivered for export this year is graphic proof of the job these farmers are doing.

During the first four months of this year the railroads carried to shipside more wheat than was ever exported before between January and April—more than *four* times as much as the average for the same period for the last *seven* years!

American farmers and American railroads were working together long before Pearl Harbor, and will be working together long after Tokyo Bay — in their common war against hunger.

AMERICAN RAILROADS

TRANSPORTATION BLDG., WASHINGTON 6, D. C.

IN PARTNERSHIP WITH ALL AMERICA

FARRINGTON

(Continued from Page 47)

in line with the continuing large requirements for oil and protein provided by soybeans.

Production goals for 1947 have not been determined yet, and will not be announced until October or November, but it is clear that shortages of oils and proteins will continue into 1947—and another large crop of soybeans will be needed in 1947 in overcoming these shortages.

There has been considerable discussion regarding the possibility of contracts being entered into with processors in connection with the 1946 crop. We recognize that the soybean processing industry is faced with some serious problems as it enters the postwar period. The industry is composed of many large and many small units. The use of the solvent extraction process has been growing year by year and now represents approximately 30 percent of the capacity of the industry. Generally speaking, the solvent extraction plants enjoy a competitive advantage over other plants. There are within the soybean industry varying degrees of vertical intregration with the feed industry and the oil refining and consuming industries. Various factors of location and freight rates will tend to influence competitive conditions in the industry.

During the war period many of these competitive forces have been held in obeyance through price controls, limitation orders, and Commodity Credit contracts which tended to equalize margins through a variable resale price of soybeans or differential subsidy to the various plants, depending upon their location, size, the type of equipment available, and the oil content of soybeans being sold.

For 1946 there appears to be no need for a subsidy in connection with the processing of soybeans. The Congress and the people of this country have clearly demonstrated that they want war-time controls ended as rapidly as practicable. We in the Department of Agriculture are in hearty agreement with that objective. Under the circumstances we see no need at this time for continuing in connection with the 1946 crop the type of control of the soybean processing industry that has been exercised during the last 4 years. Commodity Credit contracts of the type used by processors during the last 4 years are not contemplated in connection with the 1946 crop.

However, we may be able to be of some assistance to processors in connection with the financing of their 1946 crop operations. This matter is now under consideration and an early decision is expected.

Recent developments in the fats and oils situation have included the copra and coconut oil purchase agreements which have been signed with the Philippines and the Netherlands East Indies governments, and the decision of the Price Decontrol Board to reestablish maximum price regulation over the commodity group refined as "cottonseed or soybean or food or feed products processed or manufactured in whole or substantial part from cottonseed or soybeans."

The copra agreements provide for the purchase of the entire Philippine exportable surplus of copra and coconut oil by the Commodity Credit Corporation for 1 year beginning July 1, 1946, and of the exportable surplus of copra from the chief copra producing areas of the Netherlands Indies for one year beginning September 1, 1946. These purchases will be distributed under International Emergency Food Council allocations, and they should go far toward helping to alleviate the worldwide shortage of fats and oils.

When I left Washington yesterday afternoon, the fats and oils specialists in the Department of Agriculture and the Office of Price Administration were still working on the ceilings to be reestablished in accordance with the decision of the Decontrol Board for the maintenance of stable prices. OPA had announced the effective dates for the recontrol beginning August 23 through September 9 of fats and oils at the various levels of distribution: for soybeans, the effective date was set at September 3.

I can assure you that in reestablishing these price controls, both government agencies have not been unmindful of the many problems involved to producers, processors, distributors, and consumers. I can also assure you that the various set-asides and other controls which are exercised by the Department of Agriculture will be discontinued just as soon as the situation may permit. Under existing legislation, limitation orders are authorized only until March 31, 1947, and price ceilings until June 30, 1947. But we stand ready at all times to assist you in maintainnig a large, prosperous, and progressive soybean growing and processing industry.

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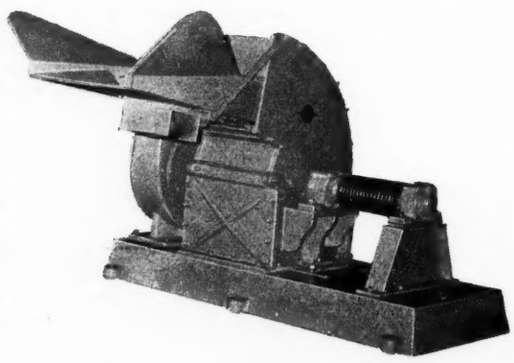
Special one-piece fan assembly increases production without additional power costs.

Small diameter cylinder revolving at high rate of speed handles more feed per hour than other principles of grinding.

This hammermill will handle all kinds of hard, bulky or stringy feed. The hard steel screens and special heavy-duty hammers are quickly interchangeable.

Vibration is reduced by the use of large alloy steel shafts, oversize ball and roller bearings and heavy cast iron base.



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"Local Mill Paid a Premium on all the Soybeans my No.12-A Harvested"

February 6, 1946

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"My John Deere No. 12-A Six-Foot Combine purchased from you in August, 1944, has given splendid service. I harvested 150 acres of soybeans that fall in 14 days. In 1945 I harvested 125 acres of soybeans requiring 15 days.

"When I sold my beans *the local mill paid a premium on all the soybeans that my combine harvested,* due to the fact they were clean and no cracked ones.

"The 1944 soybeans averaged 20 to 50 bushels per acre. The 1945 average was 25 to 45 per acre, and due to a very wet season the beans were hard to harvest. However, each season *we harvested more beans per acre than any of our neighbors* did on adjoining fields. In some cases we swapped work with neighbors using other makes of combines and every time our No. 12-A Combine would get more bushels per acre and cleaner beans than the other machines."

Yours very truly

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Reasons why the NO. 12-A Does Better Work in Beans

* The No. 12-A cuts as low as 1½-inches from ground —saves the low-growing pods.

* The gentle handling of the crop from cutter bar to cylinder prevents undue loss of beans due to shattering.

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* Full-width separating units do a thorough job of separating beans from straw.

* Extra-long cleaning shoe, and powerful, easily-controlled blast fan insure clean beans in the tank.

* Straight-through travel of beans and straw utilizes full capacity of threshing, separating, and cleaning units.

See your John Deere dealer for complete information on the John Deere No. 12-A Straight-Through Combine.

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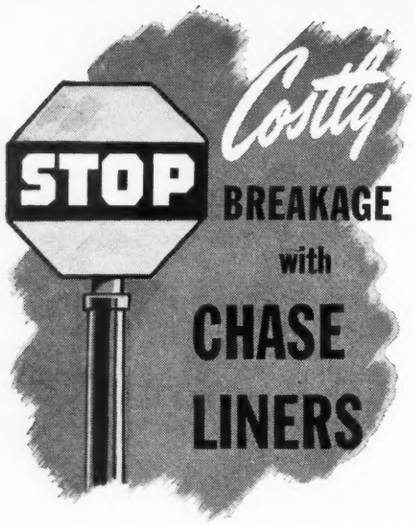

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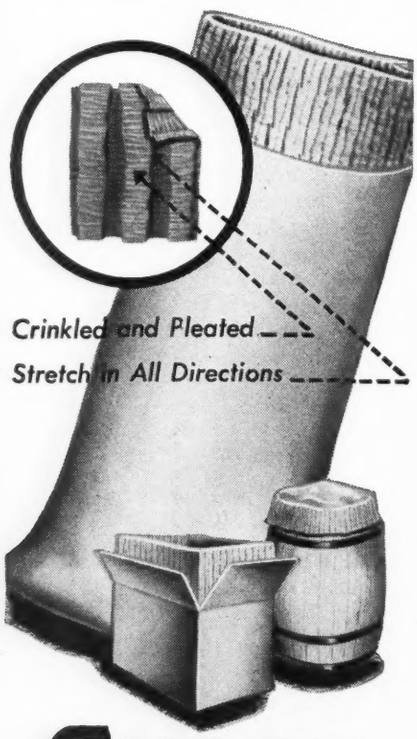

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KLEMME

(Continued from Page 32)

than is needed for the development of a significant bulk of vegetation well stocked with nutrients to be finally put into the seed, then the yields of seed will be reduced accordingly. Only fertile soils can meet the needs of high acre yields of soybean seed or forage rich in protein, minerals and vitamins.

It has been shown that plants obtain much of their plant food through contact exchange between the root hairs or active root surface and the colloidal clay and humus fractions in the soil. The soybean plant has much less root surface than small grains, grasses or even corn. In computations made by Albrecht[4], it has been shown that the soybean root can contact only about one-sixth as much of the soil as the roots of the oats plant; one-thirteenth as much as the roots of winter rye; and one-thirtieth as much as the roots of blue grass. Consequently, unless the soil is high enough in fertility to replenish quickly the supply of soil fertility as rapidly as the soybean roots remove it in their limited feeding zone, satisfactory growth and yields will not be obtained.

Soybeans require considerable fertility but are not voracious feeders because of limited root surface.

Numerous field observations show that with adequate soil treatments used in crop rotations including legumes and grasses, the fertility requirements for high acre yields of soybeans can be met. Limestone applications on lime deficient soil increase yields 5 to 7 bushels per acre. On the clay pan soils, fertilizers placed in the lower soil layers by plowing under or placing in the plow furrow with a special fertilizer attachment on a plow can also be expected to materially increase yields. For example, over a 3 year period in Barton County in southwest Missouri, an application of the equivalent of 250 pounds per acre of 0-20-10 increased the yields 5 bushels per acre.

Similar results were obtained in northeast Missouri. In 1944 on seven farms entered in the Missouri Soybean Production Contest the average yield of soybeans was 33.1 bushels per acre where soil treatments had been used for several years and the soybeans were grown in rotations with sweet or red clover, alfalfa or grass sod. On five farms where soil treatments of fertilizer were plowed under immediately ahead of planting and no legumes used in the rotation, the average yield was 24.4 bushels per acre as compared to 18.4 bushels on the untreated plots.

In general, soybeans have not been grown in systematic crop rotations with grasses and legumes. As the result of the failure to return the organic matter destroyed by cropping and to provide cover on the land immediately preceding and after the crop, soybeans have gained the reputation of being an erosive crop.

Yet during the 4 years 1941 to 1945 inclusive at the McCredie Experimental Station in Callaway County on an erosive claypan soil, the average annual soil loss by erosion was the insignificant sum of but 2.73 tons per acre, on soybeans following meadow in a soybean, barley, meadow rotation. On the other hand, on a similar plot of the same soil where soybeans followed corn in a corn, soybean, wheat, lespedeza rotation, the annual soil loss was 10.4 tons per acre. These experiments show that the crops immediately preceding and following the soybean crop greatly influence the erosion losses from a soybean field. When soybeans are grown in rotation with small grains and legumes or

4/Wm. A. Albrecht, E. R. Graham and H. R. Shepard—Surface Relationship of Roots and Colloidal Clay in Plant Nutrition—Am. Journal of Botany, Vol. 29, March, 1942.

Made from the Soybeans You Raise

THE KANSAS Soybean MILLS, Inc.
TELEPHONE 3000 EMPORIA, KANSAS

THE KANSAS Soya PRODUCTS, Inc.
TELEPHONE ATwater 1131 KANSAS CITY, KANSAS

legumes and grasses, erosion losses will not exceed or may even be less than for other crops. Where terraces are used on sloping land soil losses will be reduced to an insignificant figure.

We dare not condemn the soybean crop as an erosive crop, when it is not the crop but rather the soil that is erosive because of its poor structure and low fertility. Any newly introduced crop is received with enthusiasm when we have not yet learned its requirements and weaknesses. The soybean crop has been grown by Missouri farmers now long enough for them to assess that it has fertility requirements if it is to synthesize the protein-rich, oil-heavy seeds in bounteous yields.

MISSOURI PROGRAM

In the Missouri balanced farming program now getting under way where farm families with the help of county agents plan definite farming systems suited to the individual farm and family, soil treatments and crop rotations are planned and put in operation which will meet the fertility needs of high acre yields of feed and cash crops such as soybeans.

The present annual application by Missouri farmers of approximately 2 million tons of limestone and of nearly 200,000 tons of fertilizer annually should enable large numbers of them to establish systematic rotations in balanced farming systems in which soybeans can be grown with other legumes and grasses and include also small grains and corn. Such a program of using more mineral fertilizer fertility, with the high acre yields should enable soybeans—provided they maintain a price comparable to other crops—to continue as an important cash crop in Missouri. In addition, this program will simultaneously get higher acre yields of corn and other crops. In addition to reducing costs and increasing the farm income higher acre yields will allow the producer to practice more soil conservation. As a consequence, then more acres annually can be in the grasses and legumes—the soil conserving crops.

Soybeans are legumes and have the power to use nitrogen from the air. But they make heavy demands on the soil for calcium, phosphorus, potassium and other soil borne nutrients before they can exercise this seemingly philanthropic soil building service. It is our support of them in this soil aspect that must be exercised generously if they are to be the agricultural chemical industry for snythesizing soybean oil and soybean cake that we desire. Missouri farmers have learned to undergird this crop with limestone and other fertilizers in the recent years and thereby come to make soybeans a significant and promising future cash crop in Missouri.

—s b d—

CONTOURS PAY

All southern and central Illinois farms included in a 1945 study of contouring, reported a yield advantage for contouring soybeans, according to E. L. Sauer in *Illinois Farm Economics.*

Average yield of soybeans planted on the contour was 19.2 bushels per acre as compared with 16.2 for those not planted on the contour.

Meeting the Growing Needs of the Soybean Industry

The Soybean industry is facing an increasing demand for granular, flour free soybean meal.

The Prater Dual Screen Pulverizer produces the granular flour free grind required. Developed in cooperation with soybean processors, the Prater Dual Screen Pulverizer set the standard for this type of grind.

Prater Pulverizer Company stands ready to assist the processors in the present emergency, to meet the needs of both the solvent and mechanical process.

Industrial Division

PRATER PULVERIZER COMPANY

1501 South 55th Court

Chicago 50, Illinois

GIOVANNA

(Continued from Page 23)

uses, the fact remains that around 90 percent of the soybean oil meal manufactured today goes into livestock and poultry rations as meal or mixed feeds and over 90 percent of the oil produced goes into human foods. Very likely most of our expansion will likewise find its way into meal for feed and oil for human use. This only impresses us further as to the need for better efficiency of farming methods, plant husbandry, and processing and manufacturing efficiency.

I would like to mention here a program which has been started by the crop improvement committee of the National Soybean Processors Association. This program has been given the support of the board of directors and full membership of the Processors Association. This program entails dissemination of literature containing factual information about cultural practices best suited to soybeans, information about maintenance of soil fertility, about best varieties of soybeans for the various areas in the different regions of the soybean states and so on.

This literature is to be assembled and published only after it has been checked and rechecked for accuracy of fact. It is the plan to get the cooperation of recognized agricultural authorities. The program includes a determined plan to combat soybean diseases. This disease work will also be in coordination with the splendid work being carried on at our Universities and U. S. Regional laboratories.

It is important that in the glare of the publicity given to the spectacular new uses created by science, we do not lose sight of the fact that all the efforts of the processors, educators, scientists, and other experts, are as naught without the cooperative efforts of the grower. *For without the soybeans themselves which must be produced by the farmer there can be no products.* And unless soybeans are produced in great abundance many of the new uses so painstakingly evolved will only turn out to be useless because they would be economically unsound due to their prohibitive cost in relation to competing products.

Summing up, it seems to me that we can expand our soybean industry only by working together to achieve:

FIRST:

The production of an ever increasing crop of soybeans. That is fundamentally vital. With the increased production we must assure a simultaneously increasing return to the grower for the crop in relation to other crops competing for the same soil.

This entails educational services through such mediums as our recognized authorities, your American Soybean Association, the universities, the U. S. Department of Agriculture, the Farm Bureau, the Chemurgic Council, Soybean Research Council, the crop improvement committee of the National Soybean Processors Association, and others. It means continuous research and experimentation by all groups interested in our industry. It means we must all learn about soybean diseases and learn how to fight them.

It means further that we must find ways and means of maintaining soil fertility and of controlling soil erosion and weed control for these are distinct obstacles to larger crops. We must effect as soon as possible coordinated programs to accomplish these things and attain the mass participation of the soybean growers throughout the soybean belt, and

SECOND:

We must achieve a constantly improved efficiency in our processing industry and in the manufacture of soybean foods, industrial items and other soybean specialties. This should enable higher payments to the grower and at the same time give an ever increasing value to the consumer for his money, and

THIRD:

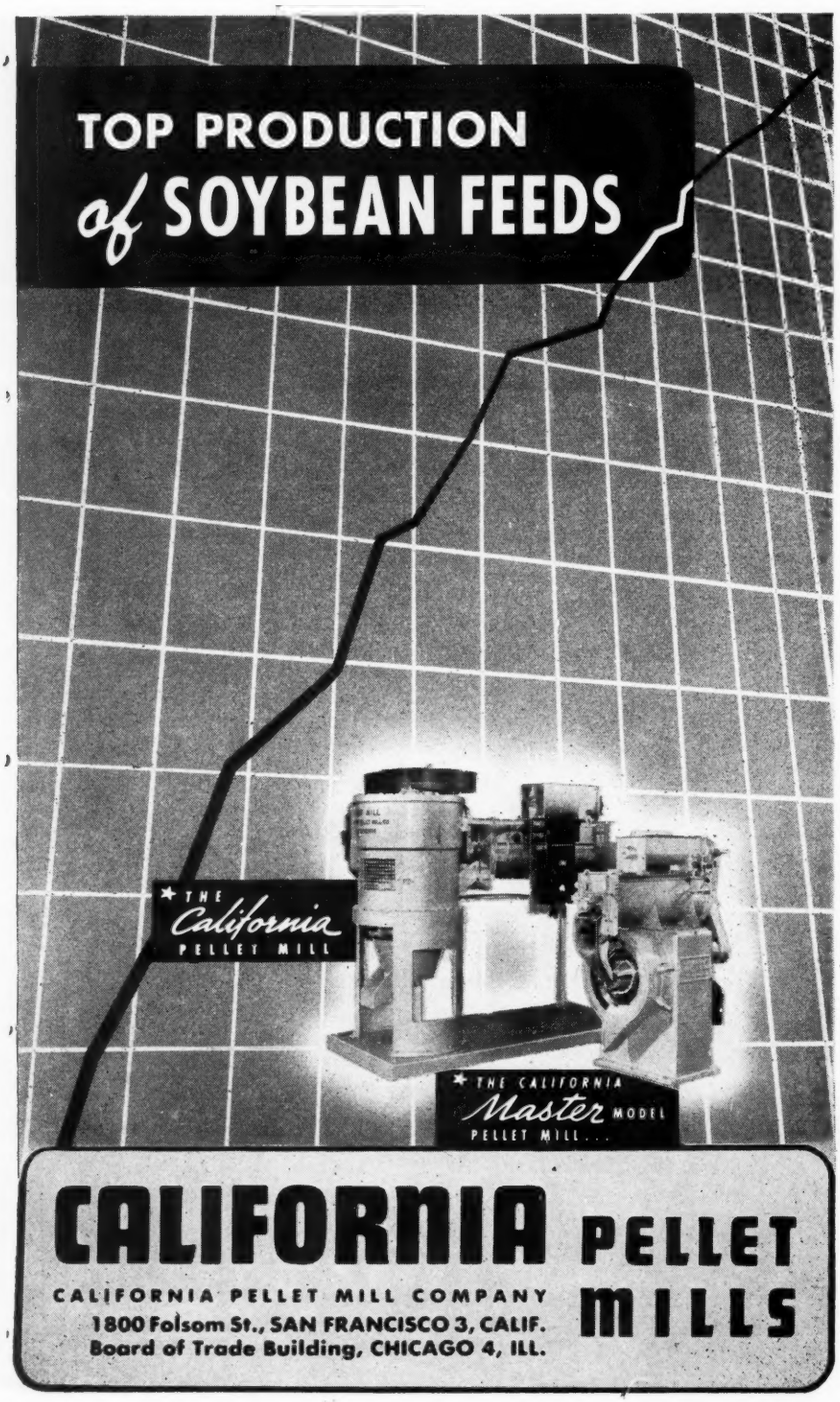
We must produce new products and discover new uses for the old products. Research on the scale now being planned will certainly be successful in achieving this, and

FOURTH:

We must coordinate our efforts to break down adverse national and state laws which restrict usage of soybean products. These products should be allowed to find their proper place in consumers channels, based on relative merit. This is not true of some soybean products today.

In closing I point out that even during this transition period there are unmistakable signs of growth and confidence in the future of our industry. The July issue of the *Soybean Digest* carries notices of the erection of approximately 2 million bushels of new storage space. These notices cover only a part of the actual expansion of storage facilities. Nearly every issue carries the story of the construction of some new processing plants.

Incidentally, you should keep up with the trends by reading the *Soybean Digest* carefully from month to month.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Soybeans are a profitable crop. They have the faculty, however, of extracting top-soil plant foods in a thorough way and crops following them may reflect this withdrawal. Plan for all of the crops of the rotation by making clover a part of it and broadcasting one thousand pounds an acre of

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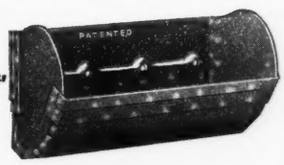

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HILBERT

(Continued from Page 34)

the war, when importations of drying oils were cut off, the lack of methods for converting domestic vegetable oils to paint oils seriously handicapped the paint industry.

Research on the development of a method for converting the soybean oil to a paint oil was undertaken by Dr. Cowan, Dr. Teeter, and S. Radlove when the Norelac program was terminated. Progress has been made in effecting the desired change in soybean oil. It has been discovered that heating soybean oil in the presence of a special preparation of nickel and carbon markedly increases the drying characteristics of the vegetable oils. A chemical concern is now actively engaged on the pilot-plant studies of this preparation or catalyst.

Paint panels prepared from the modified oil were found by A. J. Lewis of our staff to develop after-tack and to collect dust particles on outdoor exposure. Preliminary results indicate, however, that this difficulty can be overcome by proper formulation with lime. By this treatment, the modified soybean oil yielded excellent flat paint films of good durability and low dirt collection.

Commercial producers of paints and varnishes are also testing this paint for durability and general utility. The full significance of this development probably will not be apparent until the present scarcity of edible oils is relieved and restrictions are removed from the use of soybean oil in paints and varnishes.

RAW MATERIALS FROM FAT ACIDS

The development of a catalyst which imparts greater chemical activity to soybean oil has led to the preparation of new types of products from this oil. Preliminary studies indicate that compounds which are excellent plasticizers and lubricant additives can be made. One compound is a suitable plasticizer for Vinylite, a well-known commercial plastic, and two others are being studied by the Naval Research Laboratories as lubricant additives.

PLYWOOD ADHESIVES

This country annually produces large quantities of soybean oil meal which are marketed almost entirely as feed for livestock and poultry. For example, 3 million tons or more of soybean oil meal were produced in 1943. Only a very small amount of this material was used industrially.

One of the industrial uses for soybean oil meal is the preparation of adhesives, which are widely used in soft and hard plywood industries. Plywood bonded with soybean adhesives is considered to be water-resistant but not waterproof.

During the wartime emergency, the plywood industry was required to produce large quantities of waterproof plywood for the aircraft industry. For this purpose the phenolic resins rather than soybean adhesives were used. In 1942-44, the use of phenolic resins in the plywood industry increased from 21 million to 29 million pounds, while the use of soybean adhesives was decreasing from 45 million to 37 million pounds.

A method was sought to reduce the unfavorable trend of soybean adhesives and to economize on the use of phenolic resins, which were critical materials. A. K. Smith and G. E. Babcock have discovered that substantial amounts of the soybean meal, which is a byproduct in the manufacture of soybean protein, could be used as an adhesive with the phenolic resins.

One company actually made use of this discovery and produced a plywood suitable for aircraft construction. It used one-half million pounds of soybean meal in its waterproof plywood during a 12-month period from 1944 to 1945. This development served to extend supplies of phenolic resins for adhesives during the last phases of the war.

CORRUGATING STRAWBOARD FROM SOYBEAN STALKS

The strawboard industry uses 700,000 tons of wheat straw annually to produce one-half million tons of corrugating board which is used in the manufacture of shipping board. During the war, because of a lack of farm equipment and shortage of farm labor, the strawboard mills were hard pressed for wheat straw.

Drs. Lathrop and Aronovsky of the Laboratory rendered assistance to the industry by developing methods for the pulping of other agricultural residues such as soybean stalks. We found that different cooking procedures were required to handle these materials. This information was transmitted to the industry in order that it could modify its own processing conditions to handle these new raw materials efficiently. As a result of this work the industry during the period when there was a shortage of wheat straw processed 50,000 tons of soybean stalks.

SUMMARY

Several contributions on the processing and utilization of soybeans have been made. A new process for the production of soybean products of bland flavor and improved color through the alcoholic extraction of soybeans has been developed. In cooperation with an industrial company, the process was translated to a pilot-plant scale to obtain data necessary for the designing of a plant.

A method discovered in Germany for increasing the flavor stability of soybean oil has been tested and found to be quite effective. These findings and the details of the process have been transmitted to American industry. Modification of soybean oil to a product having drying characteristics comparable to linseed oil has been effected. Production of the chemical agent effecting the change in soybean oil is now being studied on a pilot plant scale by an industrial company. The new soybean paint oil is being tested by industry for durability and general utility. Plywood adhesives containing soybean meal have been developed and are being used commercially.

The progress we have made in soybean research is excellent insurance, from the standpoint of farmers, for the maintenance or expansion of markets for soybeans in the future. Our developments have aided industry in the extension and creation of new outlets for the products of the soybean. Because of the continued and increasing emphasis that is being devoted to research on soybeans by governmental agencies and by industry, we can look forward with confidence to the future of soybeans.

CASE HISTORY No. 8

One in a series of factual experiences of a group of American manufacturers with Multiwall Paper Bags.

COST COMPARISON

(Per Ton)

	Burlap Bags	Paper Bags
Container cost	$3.25	$2.80
Labor cost	.71½	.18
Total bag and labor cost	$3.96½	$2.98
Saving, paper over fabric		$0.98

CLASS OF PRODUCT PACKED

CEMENT	FERTILIZER
CHEMICALS ✓	FOOD
FEEDSTUFFS	MISCELLANEOUS

PRODUCT CHARACTERISTICS

ABRASIVE	GRANULAR
CORROSIVE	HEAVY
DELIQUESCENT	HYGROSCOPIC
FLUFFY	LIGHT ✓
FREE-FLOWING ✓	VISCOUS

ST. REGIS BAG PACKAGING SYSTEMS are made in a variety of capacities, speeds, and manpower requirements to suit specific products and plant layouts. Machines are available in types to meet the special characteristics of a wide range of products, with filling speeds as high as twenty-four 100-lb. bags per minute — with one operator.

SOME "EARTHY" FACTS

...about Packaging Economy

Fuller's Earth a "Natural" for St. Regis Packaging System: —
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....Labor Costs Cut.....75%
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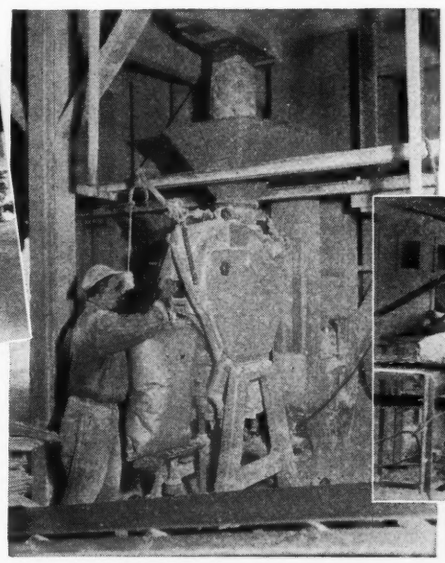
Whether you are packaging chemicals, foods, fertilizer or rock products, a St. Regis Packaging System individually designed to suit your product will effect worth-while economies. This eighth in a series of Multiwall success stories relates the experiences of the Floridin Company, Warren, Pa., processors of fuller's earth under the trade names of Floridin and Florex.

In 1945 this company installed a St. Regis 301-FB packer and began using 50-lb. Multiwall paper valve bags instead of 125-lb. burlap bags. Not only was there a saving of 45¢ per ton in container cost after switching to Multiwalls but there was also an appreciable reduction in labor costs.

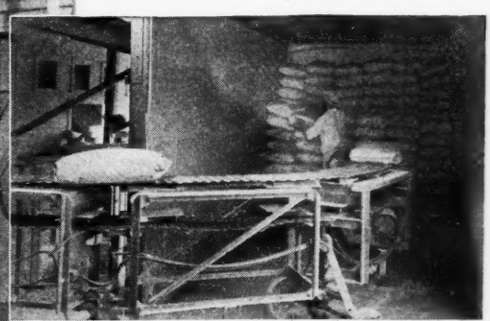
Under the old system eleven men were required to package 100 tons per day in 125-lb. burlap bags. With the St. Regis Packaging System, labor costs dropped from 71½¢ per ton to 18½¢ . . . a saving of 75%. Company officials estimate that with a battery of four St. Regis packers and a crew of only eight men they will be able to increase production to 280 tons per day . . . *an increase of 180%.*

For the full picture story on how the Floridin Company reduced container costs, increased production potential, and cut labor costs by the installation of a St. Regis Packaging System and streamlined mechanized handling equipment, mail the coupon. You will find the same basic principles applicable to *your* business.

The filled Multiwalls are dropped on a conveyor belt which carries them to a freight car.



One man operates this St. Regis packer, which simultaneously fills and weighs 50-lb. Multiwall valve bags.



This flexible, portable conveyor delivers filled Multiwalls to the box car. Note flat, compact manner in which Multiwall valve bags stack.

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Without obligation, please send me full details regarding "Case History" No. 8, outlined above.

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COMPANY_____

ADDRESS_____

CONVENTION

(Continued from Page 18)

Resolutions

(1)

With the revival of the annual meetings of the American Soybean Association, all friends of soybeans thru this resolution desire to express their appreciation to all who have worked so successfully for the success of this convention — to all speakers who have contributed up to the minute information, to exhibitors who have cooperated splendidly with the association, and to officers, committees, and individuals that have planned and worked to make this meeting an outstanding success.

(2)

To contributors who make the *Digest* a highly valued publication — to Mrs. George Strayer and Kent Pellett who carried on so effectively during the period of military service of Mr. Strayer, to George Strayer who continued effective service to the Digest while carrying on as a technical sergeant, and who subsequently has demonstrated ever increasing ability as an editor and as secretary of the American Soybean Association — to the Board of Directors offering intelligent guidance to the publication — and to other members of the staff, the Association expresses a sense of deep obligation for a publication of which it is justly proud and which has established itself as one of the finest publications in a specialized field.

(3)

Whereas importation of competing oils or fats will contribute to the disruption of an established industry, and to a hardship on soybean growing farmers, be it resolved that all policy makers be urged to give careful consideration to far reaching effects on both agriculture and industry of any such unrestricted importation before adopting such measures.

(4)

Whereas the National Association of Margarine Manufacturers has taken a stand to use only domestic fats and oils in margarine, be it resolved that this attitude receive the strong commendation of the Association.

(5)

Whereas soybean oil meal has become the most widely used protein supplement, not only of the Cornbelt, but the entire nation, be it resolved that those who are conducting experimental feeding trials be urged to include soybean oil meal in their tests wherever possible.

(6)

The Association reiterates its stand taken at previous conventions to support legislation looking toward the removal of restrictive measures and taxes on margarines containing domestically produced fats and oils; and stands ready and willing to appear before governmental agencies in further support of this attitude.

(7)

Whereas, derogatory publicity on the soybean crop frequently indicates that with the passing of war time shortages of protein and fats, the need for the soybean crop in the Cornbelt has passed, and that further production of soybeans in their areas of adaptation will impoverish the soil and contribute to its erosion, this committee desires to point out facts that stress the justification for the continuation of extensive soybean production.

1. That within the last decade, soybean processing plants and storages valued at millions of dollars have become established in the Cornbelt to provide an outlet for a crop adapted for extensive agricultural production.

2. That soybean oil meal has become the major vegetable protein source of the U. S., and that unjustified acreage reduction will impair protein supplement supplies.

3. That soybean oil has contributed half the supply of vegetable oil during the war period and has become well established in the vegetable oil field.

4. That soybeans included in Cornbelt rotations provide a crop to buffer reductions of corn and other grains that may be necessary in post war adjustments, and to provide a cash crop in a field in which there are no present Cornbelt competitors.

5. That soybeans fit admirably in a rotation system, which to hold the corn borer population in check, requires that corn stalks be turned under and that indirectly it aids in restricting ravages of other insects.

6. That research in both production and utilization will tend to extend the field of usefulness for this crop.

7. That any crop improperly handled may impoverish the soil.

8. And finally that the soybean has, is and will continue to contribute to a well established industry, and agriculture.

(8)

Sharing the special gratitude of the Association, are the following:

The National Chemurgic Council, for its frequent favorable attention to soybean developments.

The railroads crossing the soybean belt, and their agricultural agents for active interest in behalf of the crop, crop movement and industry.

The Central Soya Co. and its research staff, for an extensive production survey, a poster encouraging better varieties, and an excellent publication on production.

The National Soybean Processors Association, and its committee on crop production, also the Soybean Research Council for an impending program for further education of the public on both production and utilization.

The research agencies of the U.S.D.A., the Regional Laboratories and the state experiment stations for their rapid unfolding of worthwhile information and practices on behalf of soybeans.

The research work of pathologists on soybean diseases that promises prompt consideration of soybean diseases and work looking toward their control.

The crop improvement associations for their cooperation in the rapid multiplication and distribution of certified seed of the new varieties.

The officers and directors of the Association who have so capably directed its affairs as a service to agriculture and industry.

The industrial and manufacturing concerns interested in soybeans for their support of the *Digest* and this convention, and,

The countless friends of the soybean who in one way or another have contributed to the years of soybean progress.

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BLOOMINGTON, ILLINOIS

USDA Crop Forecast 183 Million Bushels

The official USDA forecast of 1946 soybean production dropped about 2.7 million bushels during August to an indicated output based on September 1 conditions of 183,393,000 bushels.

The August 1 forecast was for 186.2 million bushels.

Both dry and unseasonably cool weather were main reasons assigned for the decline from the August 1 estimate.

Estimated production for principal soybean growing states: Ohio 18,069,000; Indiana 25,800,000; Illinois 69,388,000; Michigan 1,484,000; Wisconsin 406,000; Minnesota 9,052,000; Iowa 32,021,000; Missouri 11,682,000; Kansas 1,672,000; Virginia 1,280,000; North Carolina 2,500,000; Kentucky 884,000; Tennessee 1,360,000; Mississippi 832,000; Arkansas 4,042,000.

Other states reporting totaled 2,921,000 bushels.

Most *Digest* correspondents continued optimistic in their forecasts though there were scattered reports of drought. September 1 reports follow:

ARKANSAS

Jacob Hartz, Stuttgart, for east central: Maturity late. Rain needed. Expected yield about normal. If fall rains normal, yield should be above 1945. No pest or disease damage to speak of.

ILLINOIS

J. E. Johnson, Champaign, for Champaign and adjoining counties: Maturity week late due to heavy rainfall resulting in heavy plant growth and continued blooming and podding. July and August rainfall much above average. Practically no rainfall last 10 days of August. Good high average but not bumper yield expected. General average should be high due to percentage of rowed beans. Total yield below 1945. Soybean growers not happy about price situation in face of serious fats and oils shortage. For this section of the state there has been a reduction of soybean acreage.

A. J. Surratt, agricultural statistician, Illinois and U. S. Departments of Agriculture, Springfield: Maturity week later than average. Plenty of moisture in main soybean section of Illinois to carry crop to maturity. Total yield about 7% less than 1945. Excellent looking crop but podding varies from light to heavy and average somewhat below indications a month ago. Except for dry area of northeastern Illinois growth tends to be rank. Considerable bud blight especially in areas of excessive rainfall in southwestern counties. Hail damage in Christian, Peoria and McLean Counties has further shortened crop prospect for state. Grasshoppers generally threaten later damage to pods, although likely moderate as there is much green growth other than soybeans this year. Recent cool wet weather has retarded development and 15-20 percent of state crop largely in southeast half needs 5 weeks to mature. Remainder of crop will not be made for nearly month yet. Drilled beans becoming weedy as usual and will be slow in drying until frosted. 15-20% of crop would be damaged by early frost.

Russell S. Davis, Clayton, for west central: Wet August has delayed maturity somewhat. Still bloom in terminal buds. Too cool for rapid development. Expected yield 20-25 bu., nearly double that of last year. Present prospect should net larger total yield than 1945, even on reduced acreage. Lots of grasshoppers but with abundant green vegetation, not expecting serious damage to bean crop. Killing frost must come in September to catch many fields. Prospect best this section has had for several years. Very few late planted fields. Plants have made big growth. Considerable lodging.

Frank S. Garwood & Sons, Stonington, for south central: Maturity slightly later than normal. Weather cold and wet delaying delivery. Expected yield per acre between 20 and 25 bu., above 1945 yields. Prospects of best soybean crop this section has seen in years. Little frost damage if frost holds off until October 1.

INDIANA

J. B. Edmondson, Clayton, for south central: Maturity normal, perhaps ahead of 1944 and 1945 by a few days. Weather conditions ideal for maturing crop. Expected yield 25 bu. average with many fields promising 30-35 bu. I should say a drop of 5% under 1945 in total yield. Smaller acreage will be partly overcome by large acre yield. Crop freest of diseases for several years. 5% or more will be caught by early frost. Corn and soybeans never looked better.

K. W. Beeson, secretary Indiana Corn Growers Association, West Lafayette: Maturity almost normal. Moisture and weather conditions excellent for major soybean growing section of state. Central Indiana prospects fine. Aug. 1 official forecast 20 bu. Total yield 7% less than 1945. Pest and disease damage slight. Some manganese and potash deficiencies showing. Plants podding and filling rapidly.

IOWA

John J. McLaughlin, State AAA, Des Moines: Maturity 105% of normal. Moisture and weather conditions good. Expected yield per acre 23 bu. Total expected yield 100% of 1945. Little possible damage by early frost.

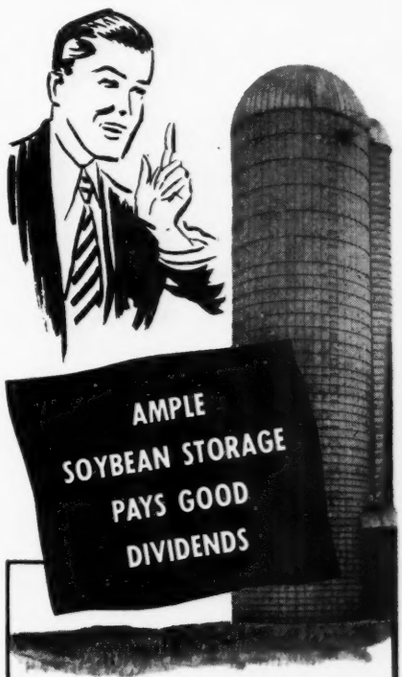
Howard L. Roach, Plainfield, for northeast: Maturity normal. Yield being hurt by lack of moisture. Expected per acre yield 20 bu. Expected total yield 90% of 1945. Very little pest or disease damage. Few late planted beans will be caught by frost.

John Sand, Marcus, for northwest: Expected per acre yield 110% of normal, which should make up for slight decrease of acreage as compared with 1945. Beans are exceptionally well podded and with continued normal weather should yield well. Favorable weather during planting season has brought about very good stand as whole.

M. G. Weiss, Iowa State College, Ames, for central: Maturity slightly earlier than normal. Moisture adequate. Weather conditions excellent. Negligible insect or disease damage. Very small possible damage by early frost.

MICHIGAN

James H. Quick, Michigan PMA state committee, Holt: Maturity about same as other years. Moisture and weather conditions good in counties that produce soybeans. Expected yield 25 bu. or better. Acreage about 15% less than 1945, but yield approximately 6 bu. more. No pest or disease damage. Very little if any possible damage by early frost.



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1946 CATALOG READY

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BINS

KANSAS

E. A. Cleavinger, extension division, Kansas State College, Manhattan, for eastern: Maturity 100% of normal. Moisture conditions in northeast, poor in southeast. Rains since Aug. 12 have helped. Expected per acre yield 8 bu. Some grasshopper damage. Few diseases. Frost damage not likely unless abnormally early frost.

N. C. Beiter, Farmer Seed & Nursery Co., Faribault, for central and southern: Maturity 2 weeks earlier than normal. Some spots too dry. Yield cut by one-third to one-half. Total yield may equal last year. Damage by early frost not probable.

John W. Evans, Montevideo, for southwest central: Maturity normal. Surface conditions becoming dry. Some corn firing. Expected per acre yield 15-20 bu. Total yield 90% of 1945. Some possible damage from too early frost.

MISSOURI

Harry A. Plattner, Malta Bend, for central: Maturity 95% normal. Moisture and weather conditions good. Expected per acre yield 25 bu. Total yield above last year. Only beans planted after wheat was harvested would be hurt by early frost.

Lyman Reed, Missouri Soybean Co., Caruthersville, Mo., for southeast Missouri, northeast Arkansas, west Tennessee: Maturity on time. Moisture and weather conditions excellent. Expected per acre yield 28 bu. Bean leaf beetle, spotted cucumber worm, green clover worm damaging crop to some extent in Arkansas.

J. Ross Fleetwood, extension specialist, University of Missouri, Columbia: Maturity 3-5 days late. Weather moist and cool over most of state. Expected per acre yield 20% above 1945. Total yield 5-10% increase over 1945. Continuation of present cool, moist weather would increase frost hazard. Normal weather from now on would safely mature crop.

NEBRASKA

John M. Slatensek, agronomist, Agricultural Experiment Station, Lincoln, for east central: Maturity close to normal. Moisture and weather conditions very favorable. More lodging than usual due to taller growth and high winds during recent rains. Prospects good for yields of 3-5 bu. more than 1945. Few beans will be caught by frost unless very early.

Fremont Cake & Meal Co., Fremont, for eastern: Maturity about normal. Expected yield per acre 25-35 bu. Possible damage by early frost very remote.

OHIO

W. G. Weigle, Marsh Foundation Farms, Van Wert, for northwest: Maturity 1 week to 10 days late. July and August dry. Cool nights last 2 weeks in August. Expected yield 18-20 bu. per acre. Total yield 15% less than 1945. Rainfall light and spotty. At weather station at Van Wert only 1.19 in. rainfall in July and 1.5 in. in August up to 25th. Ample rain south of Van Wert County. Counties north not so fortunate but more fortunate than Van Wert.

D. F. Beard, Department of Agronomy, Ohio State University, Columbus: Maturity variable. Some early and some very late fields. Average condition about normal. Moisture adequate in most of state but recently very dry in some of major bean growing counties. Expected yield 18-20 bu. per acre. Total yield 15-20% below 1945 due to reduction in acreage. Many diseases appearing on soybeans and in increasing severity. More than usual loss would occur if crop is killed by frost before Oct. 1.

G. G. McIlroy, Irwin, for west central (Aug. 24): State of maturity possibly 1 week later than should be. June gave us too much rain, more than 7 in. Since, moisture conditions better than we usually expect. August too cool. Mean temperature about 3 degrees less than last 2 years. Expected per acre yield 20-36 bu. No material damage from pests or disease has come to my attention. Some potash deficiency showing in low ground. Beans will all be beyond frost damage in another 3 weeks.

D. G. Wing, Mechanicsburg, for west central: Maturity late. Beans still blooming. Weather cool with plenty of moisture. If frost holds off will be a good crop—20-30 bu. per acre. Total yield larger than 1945 but will need until Oct. 10 to make solid beans. A September frost would catch 50% of beans in this locality. It is remarkable how July and August rains made soybeans stretch up in central Ohio. We have fields that stand well above waist still blooming. Weeds all coming in rather badly.

WISCONSIN

Geo. M. Briggs, Agricultural College, Madison: Maturity about normal. Moisture and weather conditions not too good. Too dry in late July. Grasshoppers in some places.

John Dries, Saukville, for eastern lake shore district: Maturity 100% normal. Moisture and weather conditions very dry. Expected yield normal. Total yield above 1945. Not too much pest or disease damage but diseases are coming along.

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Soybeans need lots of nitrogen. Inoculating the seed with NITRAGIN helps to supply this and helps to assure success with your soybean planting. Inoculation promotes growth of nodules and helps to save or rebuild soil fertility by nitrogen-fixation.

Farmers who inoculate with NITRAGIN report soybean yield increases, sometimes up to 50%. One experiment station reports that inoculation of soybeans is worth $10.00 an acre.

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TAKES ONLY A FEW MINUTES

FREQUENTLY ADDS DOLLARS TO PROFIT PER ACRE

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GRITS and FLAKES...

FROM THE WORLD OF SOY

Arkansas Mills, West Memphis, Ark., soybean processors have enlarged their plant in erecting a storage room 23x54, and added a new fireproof grinding room, installing new equipment. Adjoining the plant, the Famous Feed Mills of Nashville are installing a mixed feed plant to be ready for operation when the new crop comes in. R. N. Archer is manager of both plants.

* * * *

The Dannen Mills, St. Joseph, Mo., recently bought the Robinson & Son elevator, warehouses and office at Clearfield, Iowa, from Blaine Robinson.

* * * *

Leo Williams, owner of the Williams Milling Co. at Sac City, Iowa, has bought the F. H. Heise Grain Co. elevator at Nemaha, Iowa.

* * * *

Dixie Machinery Mfg. Co., 4206 Goodfellow Bldg., St. Louis, Mo., has issued a folder describing the firm's Dixie Double-Drive Hammermill.

* * * *

H. W. McMillen, vice president, has been made sales director for Central Soya Co., Inc., and all of its divisions. J. R. Turner will succeed Mr. McMillen in his former position as manager of the products division.

* * * *

Steve Babirak has joined Borden's Soybean Processing Co. as a soybean buyer. Formerly a buyer for Spencer Kellogg Co., Babirak will have offices in the Bankers Building 105 W. Adams St., Chicago.

* * * *

The Woodson-Tenent Laboratories, Memphis, Tenn., has announced the purchase of the L. B. Forbes Laboratories, Little Rock, Ark. They will be operated under the Woodson-Tenent Laboratories, Little Rock, with W. N. Kesler, as chief chemist. The firm also have laboratories at Cairo, Ill., and Blytheville, Ark.

* * * *

Soy nut operations of the Whitson products division of the Borden Co. have been transferred from Chicago to Waterloo, Iowa.

* * * *

Animal and Vegetable Fats and Oils, 1941-1945, issued by the Bureau of the Census, Department of Commerce, covers U. S. production, consumption, stocks and imports and exports of animal and vegetable oils for the above period.

* * * *

Promotion of George O. Morris to assistant sales manager of the Feed and Soy division of Pillsbury Mills, with headquarters at Clinton, Iowa, has been announced. Morris succeeds to the post formerly held by G. R. Peterson, who has been named sales manager.

* * * *

Willian B. Burr, a partner in the Zimmerman Alderson Carr Co., brokers in vegetable oils, died suddenly in Chicago August 9. He was associated with this firm as manager of the Chicago office for 30 years, and was widely known and liked by the American vegetable oil trade.

* * * *

Whitney H. Eastman, head of the chemical division of General Mills, Inc., Minneapolis, was elected a vice president of the company by the board of directors August 20

* * * *

F. Ray Linda, widely known in the paper industry through years of sales engineering and sales development work, has joined St. Regis Paper Co.'s New York office as assistant to Carl H. Hartman.

* * * *

A. E. Staley Mfg. Co., Decatur, Ill., has greatly expanded the distribution of its two-page weekly memorandum, *Feed Market News Bulletin*. Started as a mimeographed sheet in March 1945, the publication now goes to all feed quota customers.

* * * *

Dannen Grain & Milling Co., announces plans to add 1 million bushels soybean storage capacity to its present plant at St. Joseph, Mo. Capacity of the soybean mill is 1,500,000 bushels per year.

* * * *

The West Tennessee Soya Mill, Tiptonville, Tenn., will install another French Expeller for this season's crush, making three expellers.

HEARTSILL BANKS GOES TO KOREA

Heartsill Banks, for the past 2 years manager of the soybean division for the Kansas City. plant of Ralston Purina Co., has resigned to accept a position in charge of rice experimentation and breeding work for the War Department in the American occupied territory in Korea.

Mr. Banks embarked for Korea September 3. He will be stationed at Seoul and will be joined by his family in 6 months. The program is set up for 6 years, and Mr. Banks has agreed to stay on for at least 2 years.

Mr. Banks has been well known in the soybean industry for many years. Prior to his assignment at Kansas City, he was in charge of agronomy operations for Ralston Purina at Osceola, Ark. He was instrumental in developing the Ralsoy variety of soybeans.

—s b d—

SOY EXHIBIT BY PENN RAILROAD

Showing dozens of uses for soybeans, an exhibit prepared by the Pennsylvania Railroad was an added feature to the Illinois Department of Agriculture's display at 12 county fairs and the Illinois State Fair this summer.

Commenting upon the railroad's interest in the development of the soybean industry, Lewis East, head of its agricultural department says: "The production of no other crop has increased as much in a short span of years as has that of soybeans—and the impetus given industrial utilization of soys during the war should remove any apprehension in anyone's mind about the future for this miracle plant."

It will be recalled that in 1937 the Pennsy, cooperating with the American Soybean Association, National Soybean Processors' Association, U. S. Department of Agriculture and others prepared a soybean demonstration train which was operated over 18 states.

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THE MAN WHO WORKS FOR YOU is the Spencer Kellogg researcher. His laboratory job is the perfection—the discovery—the development of new uses for soybeans and soy by-products. He works in your interest because he builds and promotes the wider use of soybeans. More uses for soybeans mean a strong demand and a good cash market for soybean producers. The outlook for soybeans is good—the demand is growing steadily.

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AND SONS INC.
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FIVE SOYBEAN PROCESSING PLANTS

WASHINGTON Digest

By PORTER M. HEDGE
Washington Correspondent for The Soybean Digest

Ceilings Again After a brief holiday from price control, soybeans and soybean oil meal are back under ceilings at the same old prices for producers and processors—soybeans $2.10 a bushel at the farm; soybean oil meal $59 a ton, bulk, Decatur.

In the case of soybean oil meal, resellers are granted a somewhat higher than old-ceiling price to reflect the same percentage margin they had on Mar. 31, 1946, as required by the new OPA law.

Here are the old ceiling prices per ton of the leading oilseed meals (bagged, carlot basis):

Soybean oil meal, 41 percent protein, Chicago, $66; cottonseed meal, 41 percent protein, Memphis, $62.75; linseed meal, 32 percent protein, Minneapolis, $59.25; peanut meal, 45 percent protein, Southeastern mills, $67.25.

After Sept. 22, ceilings on mixed feeds revert to the old June 30 levels, plus any increase in the price of ingredients.

The new price decontrol board ordered ceilings back on soybeans and cottonseed and their products because of the squeeze on supplies and the increases in prices following the lapse of price control.

There is little likelihood of these commodities again being freed of price restrictions until next June 30 when OPA ends. But the law provides a mechanism which makes it somewhat easier than before to obtain price adjustments.

Main provision is the one which authorizes the Secretary of Agriculture to increase ceilings if he considers such an adjustment necessary to obtain greater production. Secretary Anderson already has used this authority to obtain higher livestock price ceilings than OPA wanted, and to increase the producer price of dry edible beans.

Whether Anderson will exercise his authority to raise soybean ceilings is uncertain, since in all probability next year's crop will be sold on a free market.

Industry advisory committees may also petition the Secretary of Agriculture, either for decontrol of a commodity or for price ceiling adjustments. Such petitions, if denied, may be carried to the Decontrol Board, which is final authority.

Price increases have been granted on certain vegetable oils, mainly to compensate for discarded subsidy payments and higher freight rates. The increases:

Standard and hydrogenated shortening and cooking oil, 60 cents a hundred; salad oil, 4½ cents a gallon; margarine, 50 cents a hundred; mayonnaise, 4 cents a gallon; salad dressing, 2 cents a gallon.

Prices of crude vegetable oils are returned to the June 30 ceiling level.

Oilseed Agreements Agreements just concluded with the Philippine and Dutch East Indies governments represent a major shift of United States policy on procurement and distribution of foreign oils.

Simply stated, the new policy is: For the U. S. to work in close conjunction with the International Emergency Food Council on allocations, to use its money, know-how, and trade goods to gain control of as much of the foreign oil supply as possible—mainly to insure a more equitable distribution of limited world supplies.

Though officials don't say so publicly, the difficulties encountered in negotiating for Argentine flax is one of the big reasons for contracting Far Eastern supplies in advance.

In both the Philippine and the East Indies agreements, the pattern for distribution control is substantially the same.

The Philippine government agrees to sell its entire exportable surplus of copra and coconut oil direct to Commodity Credit Corporation, or its designee, for a year, starting last July 1.

Foreign buyers with IEFC allocations will have to make purchase arrangements through the Fats & Oils Branch of Production & Marketing Administration.

The Netherlands Indies government agrees to sell the exportable surplus of copra from the islands for a year, beginning Sept. 1, to CCC, its designees, or to other claimants with IEFC allocations.

Under both agreements, either the U. S. or the International Food Council (on which the U. S. wields a big stick) controls the amounts other countries can obtain from these two important supply sources.

The Philippines agree to put no restrictions on production or export of copra to the U. S. This government will handle all purchases for foreign claimants, and the Philippine government will issue export licenses only to the U. S. or to its designee.

Philippine copra imports amounted to more than 52,000 tons in July, climbed to more than 60,000 tons (estimate) in August. Officials expect copra to start rolling out of the Dutch East Indies in about 2 months.

The Dutch figure a minimum of 300,000 long tons will be available for export from the East Indies within the next 12 months—an estimate which U. S. officials working on the program think is conservative.

Market for Beans Some idea of the potential market for soybeans in the next 4 to 5 years is suggested in a report on the revolution in farm technology just issued by the Bureau of Agricultural Economics under the pen of Economist Sherman E. Johnson.

The production and market outlet possibilities for soybeans suggested in the report are advanced under an assumed set of conditions that farm technology will continue to grow and become more widely adopted.

The suggested potentials are in no sense predictions, but are indications of possibilities in 1950 if fuller use continues to be made of tractors, conservation methods, fertilizer, improved seeds, etc., and if there is full employment, a high national income, and parity farm prices.

Under such conditions, the potential output of soybeans suggested by 1950 is 156,826,000 bushels compared with a wartime production (1942-44) of 190,229,000 a year. The potential market outlet is listed as 160 million bushels.

Most significant point in the report is that the trend toward bigger U. S. farm production, greatly accelerated during the war, is "irreversible," that it can't be dammed back by production controls.

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Shifting from a less to a more profitable commodity line will no longer furnish an answer for agriculture, says the report, since farm technology is pushing production to market capacity in most every line, and beyond it in many.

The only "out" for agriculture in the future, says the report, is in bigger markets, new outlets, and lower costs.

Crop Goals Department of Agriculture is planning on relatively high domestic oilseed crop goals next year, despite an expected big improvement in the world fats and oils supply situation 12 months hence.

For soybeans, the USDA goals committee is thinking tentatively in terms of an acreage about the same as this year's 11,600,000 acres for harvest.

For flax the proposed goal is 4 million acres, compared with 2,465,000 for harvest this year.

The old battle over soybean price support is expected to flare up this fall. Production officials think soybean growers ought to have about double the price of corn. Figuring that corn prices will settle down to around $1.20 to $1.25 a bushel, they recommend a support of about $2.50—if from 11 to 12 million acres of soybeans are wanted.

Diversion of the short molasses supply from production of industrial alcohol to such agricultural uses as pelleting soybean oil meal for livestock feed is being proposed by the Department of Agriculture.

Molasses supply is so low industrial alcohol plants using it have been operating at about 35 percent of capacity. No boost in supply can be expected before next spring when Cuba's cane crop comes in.

Research Operations Department of Agriculture is making tentative plans to get operations started under the new research-marketing bill by next March 1.

USDA plans to ask Congress for an appropriation as soon as the lawmakers convene next January.

The law authorizes up to $9,500,000 in the first year of operation, double that for the succeeding fiscal year.

If USDA could get work started next March, it would have a chance of getting the full authorized appropriation (19 million dollars) for the 1947-48 fiscal year.

Tentative plans are to put most of the initial funds into permanent buildings for research and development programs.

USDA Out of Procurement Department of Agriculture expects to be out of the major end of the vegetable oil procurement business by October 1.

At this time, cash paying foreign governments (such as Belgium, France, and the Netherlands) and other U. S. agencies (mainly the military) will have to make their own deals for vegetable oils, if the present time-table for dropping purchase programs is followed.

Market Street

We invite the readers of THE SOYBEAN DIGEST to use "MARKET STREET" for their classified advertising. If you have processing machinery, laboratory equipment, soybean seed, or other items of interest to the industry, advertise them here.

Rate: 5c per word per issue.
Minimum insertion $1.00.

EDIBLE OIL REFINERY. Enterprising graduate engineer having 15 years extensive experience in complete processing of edible oils and shortenings would like to join with somebody who has the financial resources to build edible oil refinery. Might also consider position as consultant. Address KP, Soybean Digest, Hudson, Iowa.

MANUFACTURERS REPRESENTATIVE. Will represent you in the Southeast. Also information of this section. Ralph H. Carlin, P. O. Box 1555, Jacksonville 1, Fla.

FOR SALE—75 new vertical steel tanks; 4,200 gallon, 10,000 gallon, 21,000 gallon and 41,000 gallon capacity in stock. Low prices. L. M. Stanhope, Rosemont, Penn.

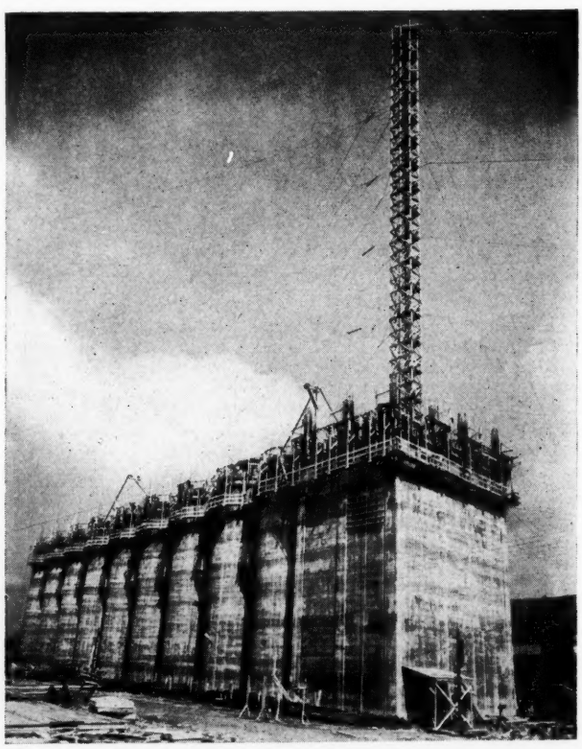
WANTED—Experienced man capable of managing all phases soybean mill operation. FS, care Soybean Digest, Hudson, Iowa.

REPRESENTATIVE soybean oil mills. Will positively give you best representation for soy oil and meal in South and Southwest Texas also South Louisiana; exclusive representations solicited also. A. E. Burgess, 401-03 United Gas Bldg., Houston, Texas.

Drackett Quality Starts Here

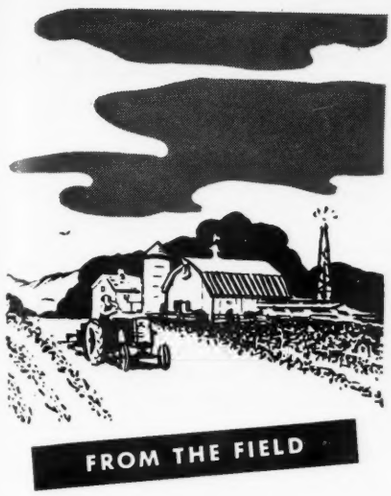
These huge silos, which will double the soybean storage capacity of The Drackett Company, will be in operation in time to receive this year's bean crop — rapidly and efficiently.

Here in these silos, with the incoming beans, is where Drackett's **rigid** laboratory control starts — and it continues all through the processing operations for the development of such high quality products as **Precision Process** Soybean Oil Meal, **AAA-1** Soybean Oil, Industrial Proteins, Plastics Molding Compounds and Azlon Fiber. These varied products, produced on a low-cost, efficient basis, help to assure growers and elevator men a ready market for their soybeans.



THE DRACKETT COMPANY

5020 Spring Grove Ave. **SOYBEAN PROCESSORS** **Cincinnati, Ohio**
Kirby 6670-7988



There's a Bemis Bag for every Soybean need

Whether you are packing soybeans, or a soybean product, such as meal, grits or flour, there are Bemis Bags to fit all your requirements.

Bemis Deltaseal Bags have the "Easy-Pour" Spout that's so popular with housewives.

Bemis Flexicartons, consumer-size packages, make excellent counter and shelf displays.

Bemis Cotton Bags have behind them four modern Bemis mills, making standardized bag cloth.

Bemis Burlap Bags are preferred for field-to-mill service. Durable and economical.

Bemis Waterproof Paperlined Textile Bags prevent sifting, protect against dirt, are exceptionally strong.

Bemis Multiwall Paper Shipping Sacks preferred for a wide range of processed products.

Bemis Packaging Engineers are available for unbiased consultation on your packaging problems. And remember, thirty-three Bemis factories and offices across the country assure convenient, reliable service.

BEMIS BRO. BAG CO.

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Charlotte • Chicago • Denver • Detroit • E. Pepperell
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Angeles • Louisville • Memphis • Minneapolis
Mobile • New Orleans • New York City • Norfolk
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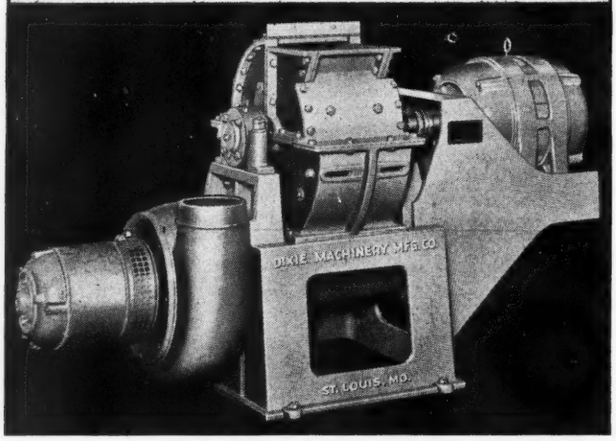
EXPERTS CALL IT

"The Greatest Feed Grinding Advance in Years"



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Not one but two individually operated motors...one to drive the hammers... the other, the suction fan.

Better feed because material is drawn off at the exact instant of its reduction to proper size.

Healthful, vitamin-packed goodness of feed preserved... not threshed out or destroyed by heat.

Up to 50% greater capacity with same horsepower. (Proved in actual tests.)

Split-atom, mechanical perfection... no belts, fewer bearings, lower up-keep.

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Distributor: Mill Engineering and Machinery Co., Oakland 12, California

Also manufacturers of Primary Cake and Hay Grinders

In The MARKETS

• ANALYSIS OF SOYBEAN PRODUCTS. A summary for Woodson-Tenent Laboratories for July.

Average Chemical Analysis of Soybeans Grown in Tennessee, Arkansas, Mississippi, Missouri.

	Oil (Oil calculated to 14% moisture) %	Oil Yields per bushel* lbs.
Average	17.6	8.1
Month's highest	18.2	8.5
Month's lowest	17.3	7.9

Average Chemical Analysis of Soybeans Grown in Iowa, Kentucky, Virginia, Kansas, Nebraska Minnesota, Wisconsin, Michigan, Ohio, Indiana, Illinois,

	Oil (Oil calculated to 14% moisture) %	Oil Yields per bushel* lbs.
Average	17.5	8.0
Month's highest	19.1	9.0
Month's lowest	15.1	6.5

Soybean Oil Meal—Average of all Soybean Meal Analysis

	Moisture	Oil	Protein	Standard
Average	12.91%	4.61%	41.87%	55
Month's best	10.36	3.74	43.19	44

Analysis of Soybean Oil

	F.F.A. %	Gardner Break %	Moisture & Volatile %	Refining Loss %	Color (red)
Average	0.8	0.87	0.14	8.0	8.4
Month's best	0.5	0.51	0.06	7.4	8.4

*Calculated 12.50% moisture and 5% oil left in meal.

• SPECIAL MARGARINE FOR EXPORT. The USDA announced that invitations for bids on 15 million pounds of margarine, to be made from coconut oil in view of the improved supply of this oil, have been issued by the Production and Marketing Administration to meet export requirements.

The margarine will be manufactured with coconut oil from the supply of Philippine copra and will be sold only to the United States government to meet foreign commitments.

This action represents an exception, at the request of the Department, to the established practice of margarine manufacturers to use domestically produced vegetable oils, in order to conserve the supply of domestic oils for domestic consumption.

• SOYBEAN INSPECTIONS. Inspected receipts of soybeans continued to decrease in July and totaled 1,908 cars compared with 2,025 cars in June, according to inspectors' reports to the Grain Branch of the Production and Marketing Administration. The average for the month of July for the crop years 1940-44 was 2,632 cars. Inspected receipts for October-July this season were 82,367 cars compared with 81,246 cars for the same period last season.

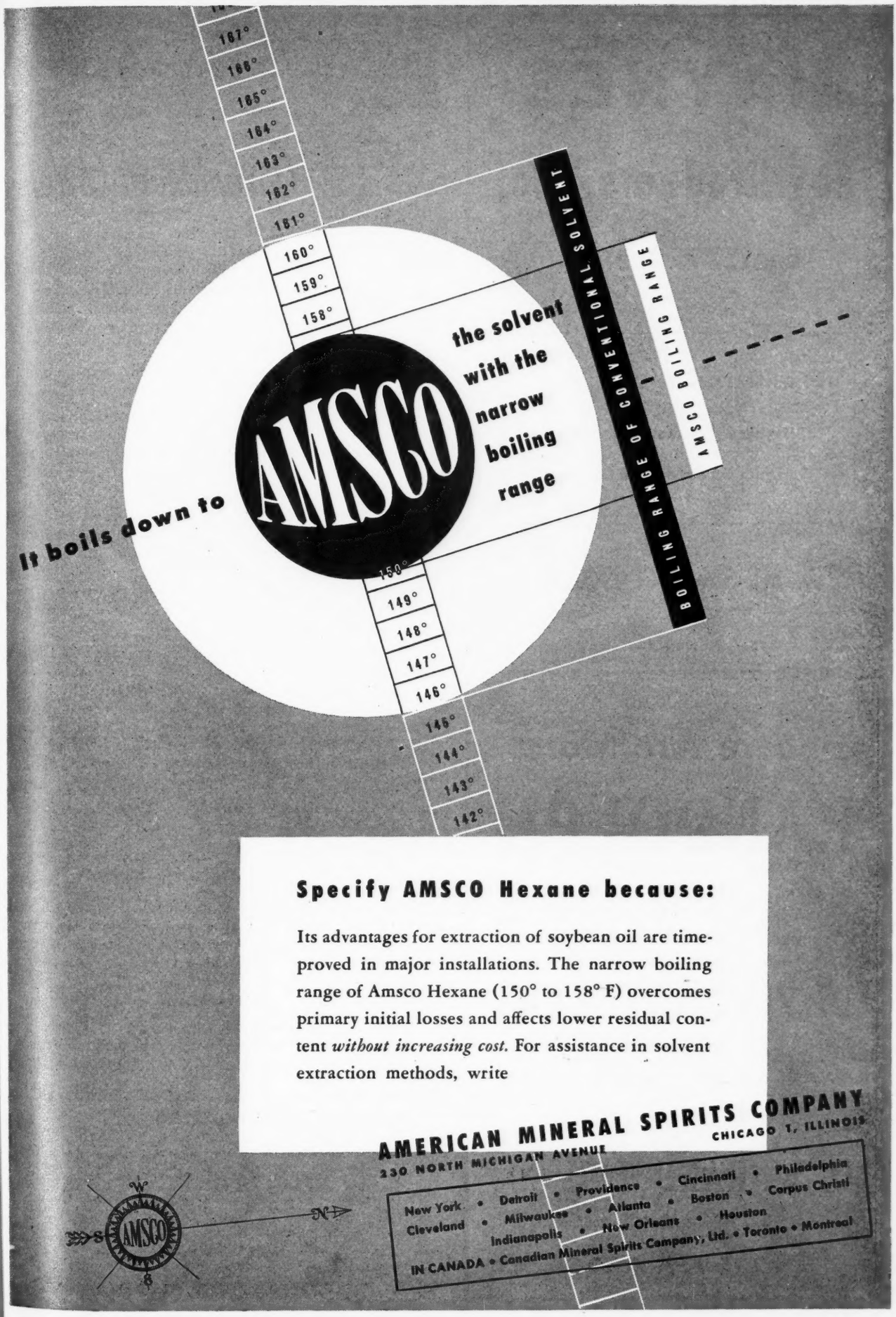
The quality of soybeans inspected in July was somewhat below that for the preceding month, 89 percent grading No. 2 or better compared with 92 percent in June.

July inspections included the equivalent of about 54 cars inspected as truck receipts.

• COMMERCIAL SOYBEAN STOCKS. Production and Marketing Administration's commercial grain stock reports for August.

U. S. Soybeans in Stock and Afloat at Domestic Markets (1,000 bu.)

	Aug. 6	Aug. 13	Aug. 20	Aug. 27
Atlantic Coast	28	20	108	4
Gulf Coast	9	9	9	9
Northwestern and Upper Lake	21	193	101	101
Lower Lake	484	379	317	261
East Central	742	613	431	319
West Central Southwestern & Western	267	225	171	133
Total current week	1,744	1,439	1,137	827
Total Year ago	3,145	2,540	2,418	1,885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BOILING RANGE OF CONVENTIONAL SOLVENT
AMSCO BOILING RANGE
It boils down to
AMSCO
the solvent with the narrow boiling range
Specify AMSCO Hexane because:
Its advantages for extraction of soybean oil are time-proved in major installations. The narrow boiling range of Amsco Hexane (150° to 158° F) overcomes primary initial losses and affects lower residual content *without increasing cost.* For assistance in solvent extraction methods, write
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Soy Products, Inc.

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Two Quality Products:

Haynes 41% Expeller Soybean Meal

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There Are More

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DRYING SOYBEANS

Than All Other
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TOLEDO -:- OHIO

• STANDARD SHORTENING SHIPMENTS. By members of Institute of Shortening Mfgrs., in pounds.

August 10	8,544,363
August 17	9,276,633
August 24	7,757,258
August 31	8,277,204

Government Orders

• OIL SEED AGREEMENTS. The International Emergency Food Council announced that it is informed by a special mission representing various claimant countries that it has concluded an overall arrangement with the Argentine government which will make substantial quantities of oils and oilseed cakes available to such claimant countries for shipment during the remainder of 1946.

All the details, including the specific terms of purchase have not yet been fully worked out.

Under terms of an agreement signed August 8, the Philippine government and the United States government have agreed to sell the entire exportable surplus of copra and coconut oil to the Commodity Credit Corporation or its designee for 1 year beginning July 1, 1946.

In each succeeding month since January 1946, copra shipments from the Philippines have risen. The largest shipments were in July when about 60,000 long tons were lifted. This quantity is around seven times larger than January shipments and approximates the prewar exports. This remarkable recovery was made possible through the efforts of the copra export Management Corporation and the Philippine Government.

Under the terms of a copra purchase agreement signed August 15, in Washington, the Netherlands Indies government has agreed to sell the exportable surplus of copra from the chief copra producing areas of the islands to the Commodity Credit Corporation, its designees or to other claimants with International Emergency Food Council allocations for one year beginning September 1, 1946, the U. S. Department of Agriculture announced.

Under this agreement the Netherlands Indies government estimates that a minimum of 300,000 long tons of copra will be made available to the world oil supply during the next 12 months.

• PRICE CEILINGS BACK. Cottonseed meal, soybean oil meal, hominy feed, linseed meal, gluten feed, mill feeds and oat mill by products come back under price control September 3, at ceilings that are unchanged from June 30 levels for processors but are somewhat higher for resellers because of new legal requirements, the Office of Price Administration said.

These feed by-products were decontrolled by the new price control act and were ordered recontrolled by the Price Decontrol Board.

FATS, OILS and OILSEEDS

By W. H. GOSS

Mr. Goss, one of the best known vegetable oil technologists in the field, was sent to Germany to report on the German oilseed industry. In this masterly 23-page mimeographed U. S. Government Report he tells of the Hansa-Muhle A. G., and Harburger Oelwerke Brinckmann und Mergell extraction plants. Full descriptions of processes, methods, machinery, etc., including valuable Cottonseed Oil chart. Particular emphasis on Soybeans. A most valuable Report for the Technical Library. Price is

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